UNIVERSITY OF GLASGOW

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COLLECTED DATA FOR TESTS ON A GUVA10 AEROFOIL

VOLUME III : *Pressure data relevant to the study of large-scale vertical-axis wind-turbines.*

by

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Herein is presented the collected data for tests in which a GUVA10 aerofoil was subjected to a variety of oscillatory displacements in pitch about the quarter-chord location at low Reynolds numbers.

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GUVA10 - VOLUME III

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NOMENCLATURE

c	chord
C_m	pitching-moment coefficient
C_n	normal force coefficient
C_p	pressure coefficient
C_t	"thrust" force coefficient
D.P.	dynamic pressure ($\rho V^2/2$)
k	reduced frequency ($\omega c/2V$)
r	reduced pitch-rate ($(c/2V)d\alpha/dt$)
TSR	tip speed ratio
Re	Reynolds number
V	velocity
x/c	chordwise dimension
α	angle of attack
ω	rotational velocity

1 INTRODUCTION

At present, in the United Kingdom, United States of America and Canada, vertical-axis wind turbines (VAWTs) typically employ the NACA 0015 aerofoil for the turbine rotors. If thicker sections could be shown to be aerodynamically satisfactory, their use would lead to a simplification in the blade design and, hence, cost reductions. As a result, the University of Glasgow is currently researching the effect on aerodynamic characteristics of varying aerofoil thickness.

As part of this investigation, in the dynamic stall facility at the University of Glasgow[1,2,3], two-dimensional data has been acquired from experiments on a number of aerofoils under a variety of motion types. **Angell et al**[4] obtained relevant lift, thrust and pitching-moment data for five aerofoil sections (NACA 0015, NACA 0018, NACA 0021, NACA 0025 and NACA 0030). From analysis of data produced by experiments on these aerofoils, a second generation of aerofoil sections have been designed. This report, the third of three, presents the collected data from a series of oscillatory tests performed on a new aerofoil which is a member of the second group. It is an 18%-thick section which was designed at the University of Glasgow by modifying the NACA 0018[5]. The coordinates for this aerofoil section, named the GUVA10, are listed in **Table 1**. The experiments are split between the three volumes as follows:

VOLUME I	*Pressure data from ramp function tests.*
VOLUME II	*Pressure data from oscillatory tests.*
VOLUME III	*Pressure data relevant to the study of large-scale vertical-axis wind turbines.*

Each volume also includes the pressure data from tests in steady conditions and a brief description of the experimental apparatus and techniques. The results from a similar series of experiments on the NACA 0018 have been presented by **Angell et al**[6,7,8].

2 DESCRIPTION OF TEST FACILITY

2.1 Aerofoil and Wind Tunnel

The general arrangement of the aerofoil in the wind tunnel was as shown in **Figure 1**. The aerofoil, of chord length 0.55m and span 1.61m, was constructed of fibre glass mounted on an aluminium spar and filled with an epoxy resin foam. The hand-finished surface was very smooth, and the profile accurate to better than 0.1mm. The instrumented model was fitted vertically into the University of Glasgow's "Handley Page" wind tunnel.

The "Handley Page" low-speed wind tunnel is an atmospheric-pressure closed-return type with a 1.61x2.13 octagonal working section (**Figure 2**) in which a wind velocity of $61ms^{-1}$ can be attained. The model was pivoted about its quarter-chord axis on two tubular steel shafts connected to the main support via two self-aligning bearings. A single thrust bearing on the top support beam took all the weight. The dynamic and aerodynamic loadings from the aerofoil were reacted to the tunnel framework by two transversely mounted beams.

2.2 Pitch Drive Mechanism

2.2.1 Actuator

Angular movement of the model was obtained using a linear hydraulic actuator and crank mechanism. The actuator was mounted horizontally below the tunnel working section on the supporting structure, with the crank rigidly connected to the tubular part of the spar by a welded sleeve and keyway. The acuator was a UNIDYNE 907/1 type with a normal dynamc thrust of 6.1KN operated from a supply pressure of 7.0MNm^{-2}. A MOOG 76 series 450 servo valve was used via a UNIDYNE servo controller unit to control the movement of the actuator. A suitable feedback signal for the controller was provided by a precision linear angular displacement transducer geared to the main spar of the model.

2.2.2 Command Signal

The model's angle of attack was incremented by the actuator controller. The input signal during the static tests was provided under software control by the data acquisition unit's own digital-to-analogue converter. This was possible because, during the sampling, the angle of attack was fixed and sufficient time was available between sampling to set the model at the required angle of attack. The two activities were separate and were performed sequentially.

Such was not the case during the unsteady tests, however, where sampling and control of the model's motion were required simultaneously. Therefore, during these tests, the input signal was provided by a separate function generator, comprised of an AMSTRAD 1512 microcomputer equipped with an ANALOG DEVICES RTI815 multi-function input/output board. The required output function was digitised into equal time steps in 2's complement code and the frequency of the function was controlled using the internal interrupts of the AMSTRAD microcomputer. The code was written in TURBO PASCAL.

2.3 Instrumentation and Data Logging

2.3.1 Pressure Transducers

To provide the chordwise pressure distribution at mid-span, thirty KULITE XCS-093-5 PSI G ultra-miniature pressure transducers were installed just below the surface of the centre section of the model. The transducers were of vented gauge type with one side of the pressure sensitive diaphragm open to the ambient pressure outside the wind-tunnel (via tubes in the model). Each transducer was fitted with a temperature compensation module, which minimised the change in zero-offset and sensitivity with temperature. The locations of the pressure transducers in the model are illustrated in **Figure 3**.

The low voltage outputs from the thirty presure transducers were suitably amplified and conditioned by a bank of differential amplifiers. The conditioned signals were passed to a "sample and hold" unit[1,9] to overcome the time-skew problem arising from the sequential conversion of the anlogue signals into digital form.

2.3.2 Dynamic Pressure

The dynamic pressure in the wind tunnel working section was determined by measuring the difference between the static pressure in the working section, 1.2m upstream of the leading edge, and the static pressure in the settling chamber. The pressure tappings were connected to a FURNESS FC012 micromanometer, which provided an analogue signal suitable for the data acquisition unit's analogue-to-digital converter. This dynamic pressure was recorded as the sample-and-hold unit was triggered to sample the output from the pressure transducers.

2.3.3 Incidence

The instantaneous angle of attack of the aerofoil was determined by an angular displacement transducer geared to the model's main spar. The signal voltage from the transducer was fed into an amplifier/splitter to produce three signals for the following purposes:

i) connection of the multiplexer for recording the aerofoil's angle of attack;

ii) connection of the Schmitt trigger for initiation of data sampling when a preset incidence (voltage) was attained;

iii) a feedback signal to the hydraulic actuator controller.

2.3.4 Acquisition Unit

The actual data acquisition unit was a DEC MINC-11 microcomputer, configured with an

LSI-11/32 16-bit microprocessor and laboratory modules which included:

i) an analogue-to-digital converter module, with a 16-channel multiplexer incorported. The converter was a 12-bit successive approximation type with a conversion time of of 30μs, but the multiplexer's settling time and the need to transfer the data from the analogue-to-digital converter into system memory increased the conversion time to 44μs;

ii) a multiplexer module, of 16 single-ended channels, which increased the number of channels that could be sampled to 32;

iii) a real-time clock module, with two Schmitt triggers. This was used as a time-base generator to accurately set the sampling frequency. The sampling frequency was determined at run time from the frequency of oscillation and the requirement that 128 sample sweeps should be obtained during each cycle. One of the Shmitt triggers was used to initiate data sampling, by setting its reference voltage to a value corresponding to the angular displacement transducer's output for the required mean angle of attack;

iv) a digital-to-analogue converter module which housed four independent 12-bit digital to analogue converters. This was used to provide the command signal for the hydraulic actuator during static tests.

The path of data flow and system layout is shown diagrammatically in **Figure 4**. The main control programs for the tests were written in FORTRAN IV, as described by **Murray-Smith and Galbraith**[10]. The programs prompt the user for specific run information before calling a specialised subroutine written in MACRO-11 assembly language to receive and store the digitised data. The timing and control of the analogue-to-digital converter and associated circuitry was performed by the processor's hardware, but channel selection and data management were achieved under software control.

3 TEST SERIES AND PROCEDURE

3.1 Static Experiment

A number of experiments were performed under steady conditions. Once the wind velocity had reached the required value, the aerofoil was rotated about its quarter-chord axis until it was positioned at the incidence at which the first set of data were to be recorded. Usually, this was approximately -2°. The model's angle of attack was then increased in steps of approximately 0.5°. After each increment in incidence, the flow was allowed to stabilise for a few seconds before each transducer's output was sampled 100 times and the mean value for each was stored. After 64 sweeps of data had been recorded, the model was returned to its starting position. Data sampling was maintained at the same rate on the return arc in order to record any delay in the reattachment of flow.

3.2 Sinusoidal Experiment

For this experiment, the model was rotated about its quarter-chord axis so that its angle of attack varied sinusoidally with time. The amplitude and frequency were controlled by the AMSTRAD function generator. During each oscillatory cycle 128 data sweeps were recorded and logged, with data being sampled during ten cycles.

3.3 VAWT Experiment

The VAWT experiment was designed to emulate the incidence time histories encountered by the blade of a vertical-axis wind turbine. A computer algorithm, coded in FORTRAN 77, has been developed at the University of Reading to calculate the blade's angle of attack as a function of its azimuth position. The program can use both single and multiple streamtube models[11] based on SANDIA[12] data for the NACA series of aerofoil characteristics.

At low tip-speed ratios the time history for the single streamtube model is a skewed sine function, but this tends toward a true sine as the tip-speed ratio is increased. The upwind (positive) and downwind (negative) sections of each cycle attain identical peak values of incidence. Tip-speed ratio and amplitude are related as follows:

TSR	Amplitude
6.00	5.4^{o}
4.00	9.9^{o}
3.50	12.2^{o}
3.25	13.8^{o}
2.80	17.4^{o}
2.33	22.6^{o}
1.75	32.8^{o}

The AMSTRAD function generator reproduced the angle of attack histories based upon the NACA 0015 aerofoil's characteristics. Data acquisition was performed in an identical manner to that for sinusoidal tests.

In addition, a number of non-standard VAWT experiments were performed. Each is described in **Table 5**.

3.4 Procedure

Before each individual set of tests, the tunnel was shut down and the air flow allowed to cease before the transducer offsets were logged. Immediately after these values were recorded, the appropriate data acquisition routine was initiated whilst the tunnel was brought up to speed and thence data gathered as per the software prompts. The tunnel was then shut down, offsets logged again and further tests were performed in the manner described above.

3.5 Roughness Transition Strips

A number of the experiments were repeated with graded sand deposited at the aerofoil's leading edge. It was intended that this should trip the boundary layer in the leading-edge region. A direct comparison can be made between tests with and those without these roughness transition strips.

3.6 Data Presentation

All data collected by the data acquisition routines were stored in unformatted form on magnetic tape. A library of programs (coded in FORTRAN 77) is available for the reduction, presentation and analysis of the data on a DEC MICROVAX 3400. By applying offsets, gains and calibrations, the data reduction programs convert the cycles of raw data into averaged or unaveraged non-dimensional pressure coefficients. As described by **Leitch and Galbraith**[13], these data are stored on the University of Glasgow's aerofoil database. The airloads are determined by suitably integrating the pressure coefficient values.

4 RESULTS AND DISCUSSION

4.1 Tunnel Performance

Assessment of the quality of the data can only be made with a clear insight of the tunnel effects. Unfortunately the tunnel performance was such that, for the time scales of the model motion, it was not possible to hold the dynamic pressure in the working section constant whilst altering the blockage due to the pitching of the aerofoil. During the static tests (i.e. **k**=0.0 and **r**=0.0), this variation was as illustrated in **Figure 5**, where it can be seen that there was approximately a 30% reduction in dynamic pressure as the angle of attack was increased from 0° to 30°. As illustrated in **Figures 6** and **7**, this reduction in dynamic pressure decreased as reduced frequency increased.

Figure 8 reveals that, during ramps, there was a drastic reduction and subsequent unsteadiness in the dynamic pressure during a test. The model was pitched to an incidence of 40° so that uniform ramp conditions existed at stall. Once the aerofoil had stalled, however, all significant data had already been collected and the corresponding dynamic pressure reduction was only in the region of 10%. The subsequent data are of little relevance to the current work and is presented merely for completeness.

4.2 Averaging of the Data

The main data in this report are the average of a number of cycles. Individual cycles are presented in **Figures 9** and **10** where it may be seen that, whilst minor random differences do exist from cycle to cycle, the salient features are highlighted by the averaging process. In addition, the sweep at which any event occurred did not vary. Therefore the given data may be considered as typical of aerofoil performance during any given individual cycle. This is particularly relevant when considering the detailed flow phenomena of separation and reattachment.

4.3 Test Data

The test data are grouped for each motion type with compact details of the specific tests listed in **Tables 2** to **5**.

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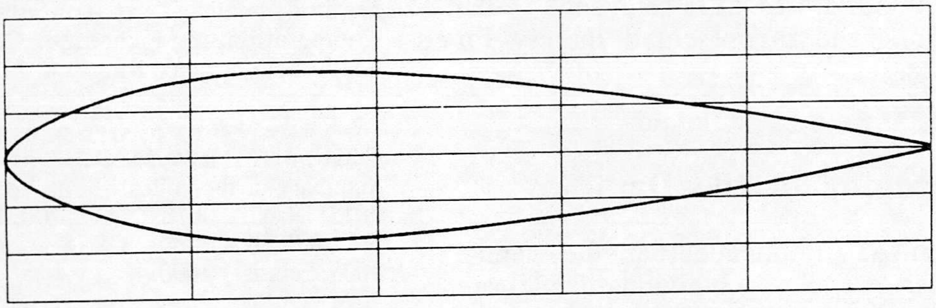
TABLE 1 : GUVA10 AEROFOIL PROFILE AND COORDINATES



Coordinates in %Chord

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.000	0.000	0.000	0.000
0.120	0.567	0.120	-0.567
0.482	1.131	0.482	-1.131
1.082	1.750	1.082	-1.750
1.921	2.416	1.921	-2.416
2.997	3.112	2.997	-3.112
4.306	3.823	4.306	-3.823
5.846	4.537	5.846	-4.537
7.612	5.243	7.612	-5.243
9.601	5.928	9.601	-5.928
11.808	6.582	11.808	-6.582
14.227	7.193	14.227	-7.193
16.853	7.748	16.853	-7.748
19.679	8.232	19.679	-8.232
22.699	8.624	22.699	-8.624
25.905	8.887	25.905	-8.887
29.289	8.997	29.289	-8.997
32.844	8.986	32.844	-8.986
36.561	8.868	36.561	-8.868
40.430	8.680	40.430	-8.680
44.443	8.413	44.443	-8.413
48.590	8.071	48.590	-8.071
52.860	7.657	52.860	-7.657
57.244	7.175	57.244	-7.175
61.732	6.628	61.732	-6.628
66.311	6.020	66.311	-6.020
70.972	5.353	70.972	-5.353
75.702	4.630	75.702	-4.630
80.491	3.853	80.491	-3.853
85.327	3.021	85.327	-3.021
90.198	2.134	90.198	-2.134
95.093	1.191	95.093	-1.191
100.000	0.189	100.000	-0.189

TABLE 2 : DETAILS OF STATIC TESTS

TABLE 2.1 : SUMMARY OF STATIC TESTS (nominal)

Reynolds Number	$0.8x10^6$	$1.1x10^6$	$1.5x10^6$	$2.0x10^6$
Angle of Attack	-2^o to 30^o			

(all permutations)

TABLE 2.2 : LIST OF STATIC TESTS (actual)

Run Number	Start (°)	Sweep (°)	Reynolds No. x 10^{-6}
00011	-2	32	1.51
00741	-2	32	1.04
00831	-2	32	2.07
00921	-2	32	1.43
01681	-2	32	1.54
02311	-2	32	1.56
03471	-2	32	1.56
03871	-2	32	0.99
04041	-2	32	1.93
04211	-2	32	1.99
04361	-2	32	1.08
04511	-2	32	0.78
04661	-2	32	1.52
*805371	-2	32	1.53
*805571	-2	32	1.55
*806131	-2	32	1.54

(*experiments with roughness transition strips)

TABLE 3 : DETAILS OF SINUSOIDAL EXPERIMENTS

TABLE 3.1 : SUMMARY OF SINUSOIDAL EXPERIMENTS AT FIXED REDUCED FREQUENCY (nominal)

Mean Angle	0°						
Amplitude	5.4°	10.0°	12.2°	13.8°	17.4°	22.6°	32.8°
Reduced Frequency	0.05						
Reynolds Number	$0.8x10^6$	$1.1x10^6$	$1.5x10^6$	$2.0x10^6$			

(all permutations)

TABLE 3.2 : SUMMARY OF SINUSOIDAL EXPERIMENTS AT FIXED REYNOLDS NUMBER (nominal)

Mean Angle	0°						
Amplitude	5.4°	10.0°	12.2°	13.8°	17.4°	22.6°	32.8°
Reduced Frequency	0.02	0.04	0.05	0.06	0.075		
Reynolds Number	$1.5x10^6$						

(all permutations; tests at reduced frequencies of 0.075 were repeated with roughness transition strips)

TABLE 3.3 : LIST OF SINUSOIDAL EXPERIMENTS (actual)

Run Number	Mean (°)	Amp'ude (°)	Reduced Frequency	Reynolds No. x 10^{-6}
14221	0	5.4	0.052	1.91
14231	0	10.0	0.052	1.90
14241	0	12.2	0.052	1.90
14251	0	13.8	0.052	1.90
14261	0	17.4	0.052	1.89
14271	0	22.6	0.052	1.89
14281	0	32.8	0.052	1.89
14441	0	5.4	0.052	1.08
14451	0	10.0	0.052	1.08
14461	0	12.2	0.052	1.08
14471	0	13.8	0.052	1.08
14481	0	17.4	0.052	1.08
14491	0	22.6	0.052	1.08
14501	0	32.8	0.052	1.08

TABLE 3.3 : LIST OF SINUSOIDAL EXPERIMENTS (concluded)

Run Number	Mean (°)	Amp'ude (°)	Reduced Frequency	Reynolds No. x 10^{-6}
14521	0	5.4	0.053	0.78
14531	0	10.0	0.053	0.78
14541	0	12.2	0.053	0.78
14551	0	13.8	0.053	0.78
14561	0	17.4	0.053	0.78
14571	0	22.6	0.053	0.78
14581	0	32.8	0.053	0.78
14671	0	5.4	0.053	1.51
14681	0	10.0	0.053	1.50
14691	0	12.2	0.053	1.50
14701	0	13.8	0.053	1.50
14711	0	17.4	0.053	1.50
14721	0	22.6	0.053	1.50
14731	0	32.8	0.053	1.49
14881	0	5.4	0.021	1.48
14891	0	10.0	0.021	1.48
14901	0	12.2	0.021	1.48
14911	0	13.8	0.021	1.48
14921	0	17.4	0.021	1.48
14931	0	22.6	0.021	1.48
14941	0	32.8	0.021	1.47
14951	0	5.4	0.042	1.48
14961	0	10.0	0.042	1.47
14971	0	12.2	0.042	1.47
14981	0	13.8	0.042	1.47
14991	0	17.4	0.042	1.47
15001	0	22.6	0.042	1.47
15011	0	32.8	0.042	1.46
15161	0	5.4	0.063	1.47
15171	0	10.0	0.063	1.47
15181	0	12.2	0.063	1.47
15191	0	13.8	0.063	1.47
15201	0	17.4	0.063	1.47
15211	0	22.6	0.063	1.47
15221	0	32.8	0.063	1.47
15231	0	5.4	0.080	1.46
15241	0	10.0	0.080	1.46
15251	0	12.2	0.080	1.46
15261	0	13.8	0.080	1.46
15271	0	17.4	0.080	1.46
15281	0	22.6	0.080	1.46
15291	0	32.8	0.080	1.46
*815501	0	5.4	0.081	1.51
*815511	0	10.0	0.081	1.50
*815521	0	12.2	0.081	1.50
*815531	0	13.8	0.081	1.50
*815541	0	17.4	0.081	1.50
*815551	0	22.6	0.081	1.50
*815561	0	32.8	0.080	1.50

(*experiments with roughness transition strips)

TABLE 4 : DETAILS OF SINGLE STREAMTUBE VAWT EXPERIMENTS

TABLE 4.1 : SUMMARY OF VAWT EXPERIMENTS AT FIXED REDUCED FREQUENCY (nominal)

Mean Angle	0^o						
Tip Speed Ratio	1.75	2.33	2.80	3.25	3.50	4.00	6.00
Reduced Frequency	0.05						
Reynolds Number	$0.8x10^6$	$1.1x10^6$	$1.5x10^6$	$2.0x10^6$			

(all permutations)

TABLE 4.2 : SUMMARY OF VAWT EXPERIMENTS AT FIXED REYNOLDS NUMBER (nominal)

Mean Angle	0^o						
Tip Speed Ratio	1.75	2.33	2.80	3.25	3.50	4.00	6.00
Reduced Frequency	0.02	0.04	0.05	0.06	0.075		
Reynolds Number	$1.5x10^6$						

(all permutations)

TABLE 4.3 : LIST OF VAWT EXPERIMENTS (actual)

Run Number	Mean (^{o})	TSR	Reduced Frequency	Reynolds No. x 10^{-6}
54291	0	6.00	0.052	1.97
54301	0	4.00	0.052	1.96
54311	0	3.50	0.052	1.96
54321	0	3.25	0.052	1.95
54331	0	2.80	0.052	1.95
54341	0	2.33	0.051	1.94
54351	0	1.75	0.051	1.94
54371	0	6.00	0.052	1.08
54381	0	4.00	0.052	1.08
54391	0	3.50	0.052	1.08
54401	0	3.25	0.052	1.08
54411	0	2.80	0.052	1.08
54421	0	2.33	0.052	1.08
54431	0	1.75	0.050	1.09

TABLE 4.3 : LIST OF VAWT EXPERIMENTS (concluded)

Run Number	Mean (°)	TSR	Reduced Frequency	Reynolds No. x 10^{-6}
54591	0	6.00	0.053	0.79
54601	0	4.00	0.053	0.79
54611	0	3.50	0.053	0.79
54621	0	3.25	0.053	0.79
54631	0	2.80	0.052	0.82
54641	0	2.33	0.052	0.82
54651	0	1.75	0.052	0.82
54741	0	6.00	0.052	1.51
54751	0	4.00	0.052	1.51
54761	0	3.50	0.052	1.51
54771	0	3.25	0.052	1.51
54781	0	2.80	0.052	1.51
54791	0	2.33	0.052	1.50
54801	0	1.75	0.052	1.50
54811	0	6.00	0.021	1.50
54821	0	4.00	0.021	1.50
54831	0	3.50	0.021	1.50
54841	0	3.25	0.021	1.49
54851	0	2.80	0.021	1.49
54861	0	2.33	0.021	1.49
54871	0	1.75	0.021	1.49
55021	0	6.00	0.042	1.49
55031	0	4.00	0.042	1.49
55041	0	3.50	0.042	1.49
55051	0	3.25	0.042	1.49
55061	0	2.80	0.042	1.49
55071	0	2.33	0.042	1.49
55081	0	1.75	0.042	1.48
55091	0	6.00	0.063	1.46
55101	0	4.00	0.063	1.46
55111	0	3.50	0.063	1.46
55121	0	3.25	0.063	1.46
55131	0	2.80	0.063	1.46
55141	0	2.33	0.063	1.45
55151	0	1.75	0.063	1.45
55301	0	6.00	0.081	1.45
55311	0	4.00	0.081	1.44
55321	0	3.50	0.081	1.44
55331	0	3.25	0.081	1.44
55341	0	2.80	0.081	1.44
55351	0	2.33	0.081	1.44
55361	0	1.75	0.081	1.44

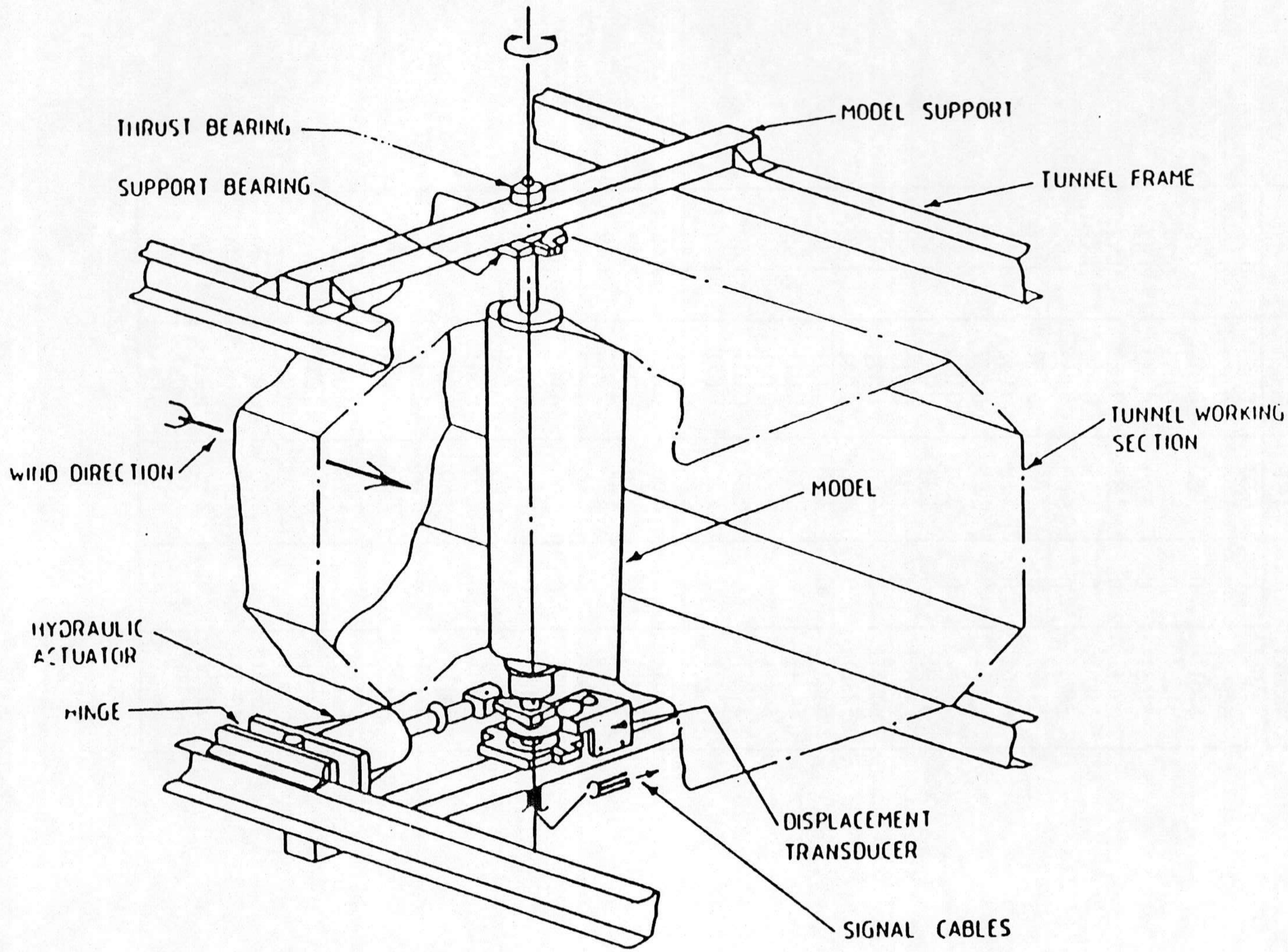


FIGURE 1 : GLASGOW UNIVERSITY'S DYNAMIC STALL RIG

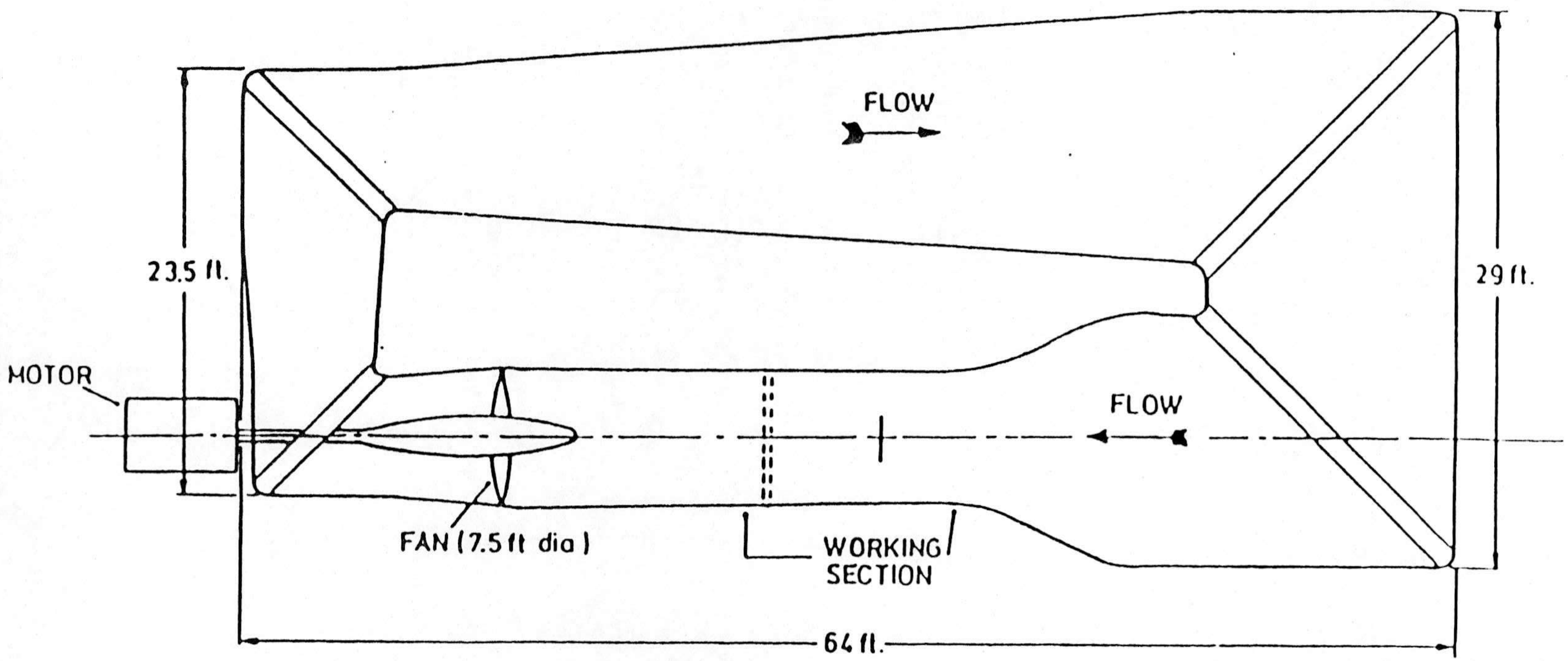
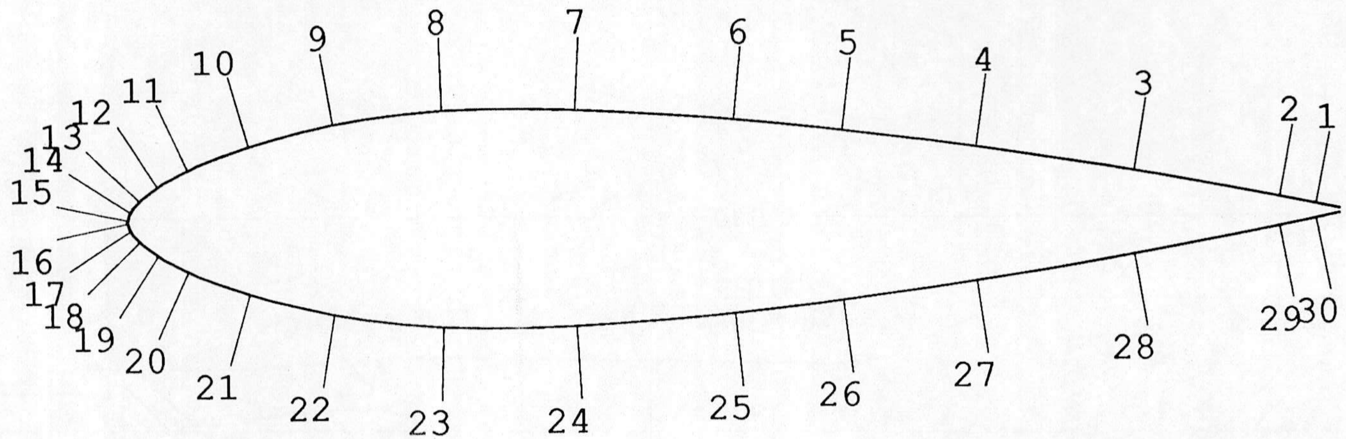


FIGURE 2 : PLAN VIEW OF THE GLASGOW UNIVERSITY "HANDLEY PAGE" 7ft X 5ft 3in WIND TUNNEL



X(1)/C = 0.98000	X(11)/C = 0.05000	X(21)/C = 0.10000
X(2)/C = 0.95000	X(12)/C = 0.02500	X(22)/C = 0.17000
X(3)/C = 0.83000	X(13)/C = 0.01000	X(23)/C = 0.26000
X(4)/C = 0.70000	X(14)/C = 0.00250	X(24)/C = 0.37000
X(5)/C = 0.59000	X(15)/C = 0.00025	X(25)/C = 0.50000
X(6)/C = 0.50000	X(16)/C = 0.00025	X(26)/C = 0.59000
X(7)/C = 0.37000	X(17)/C = 0.00250	X(27)/C = 0.70000
X(8)/C = 0.26000	X(18)/C = 0.01000	X(28)/C = 0.83000
X(9)/C = 0.17000	X(19)/C = 0.02500	X(29)/C = 0.95000
X(10)/C = 0.10000	X(20)/C = 0.05000	X(30)/C = 0.98000

FIGURE 3 : PRESSURE TRASDUCER LOCATIONS FOR THE GUVA10.

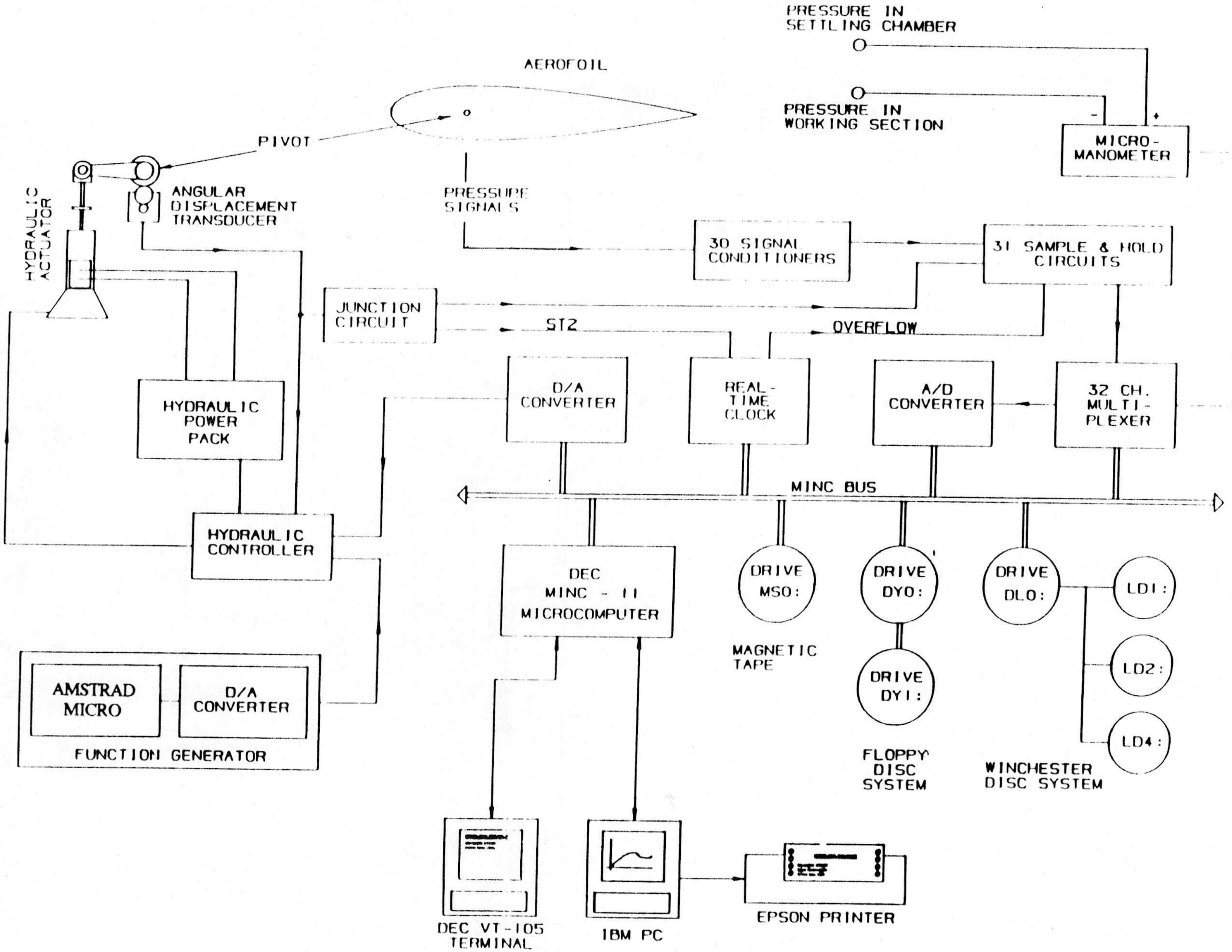


FIGURE 4: SYSTEMATIC ARRANGEMENT OF DATA ACQUSITION AND CONTROL SYSTEM

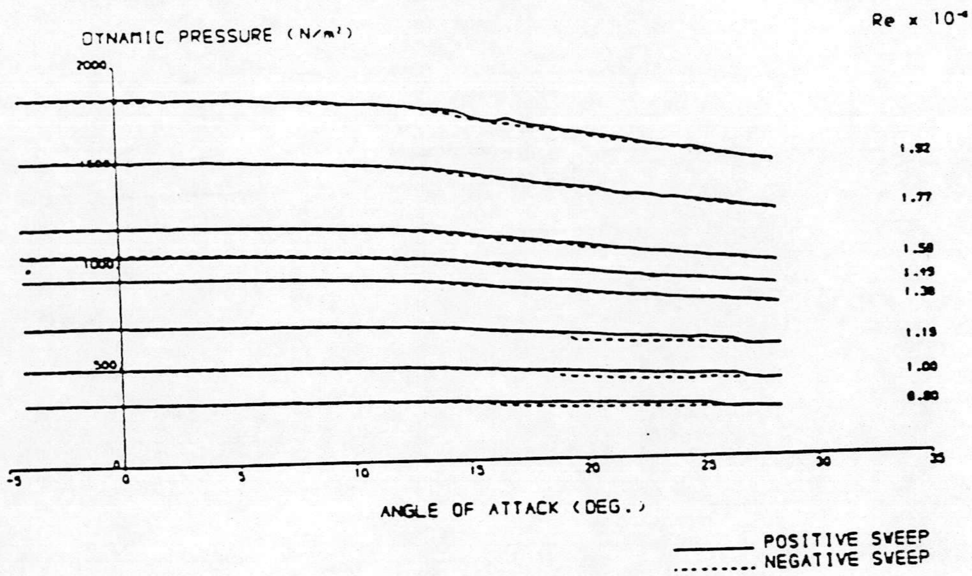


FIGURE 5 : REDUCTION OF DYNAMIC PRESSURE WITH INCREASING ANGLE OF ATTACK.

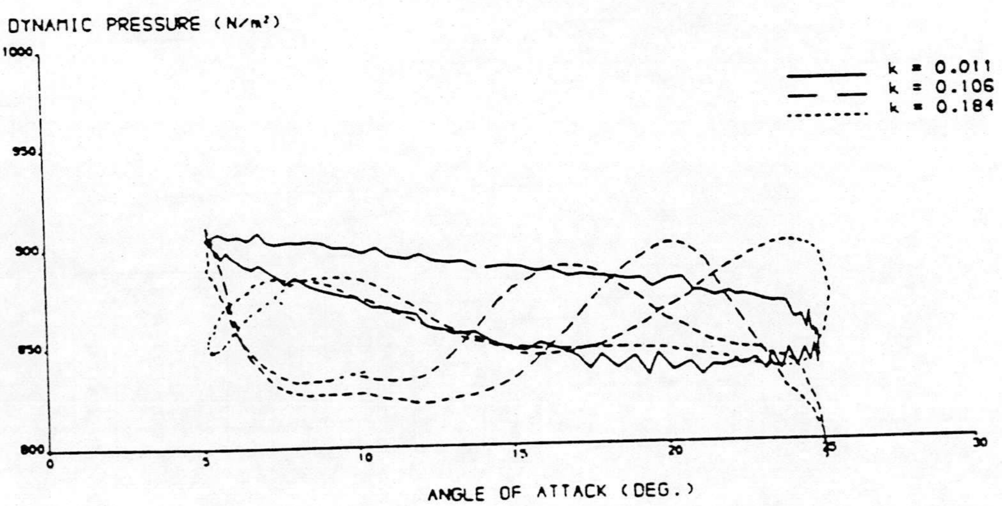


FIGURE 6 : VARIATION OF DYNAMIC PRESSURE DURING OSCILLATORY TESTS.

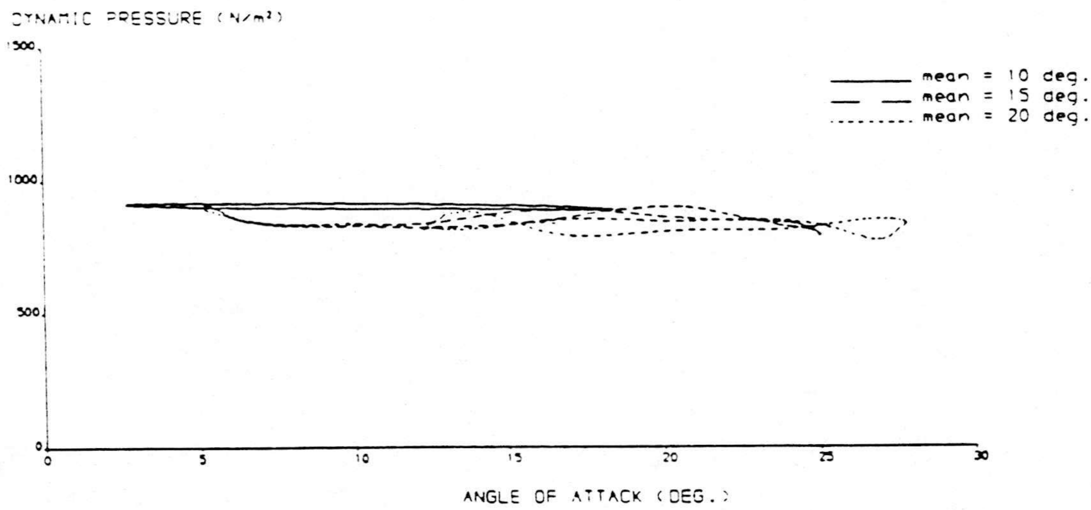


FIGURE 7 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS MEAN ANGLES OF ATTACK AT A REDUCED FREQUENCY OF 0.10.

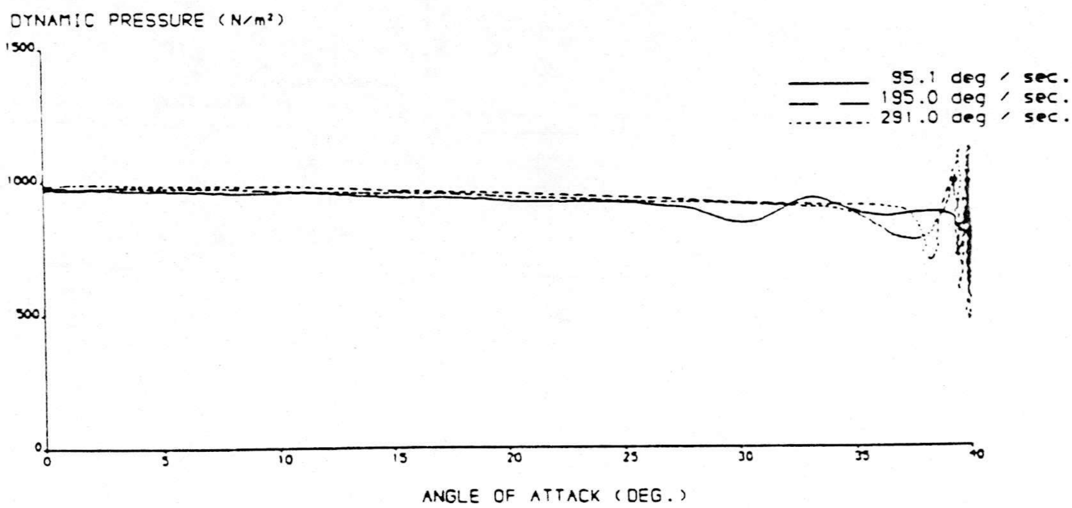


FIGURE 8 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS PITCH RATES DURING RAMP TESTS.

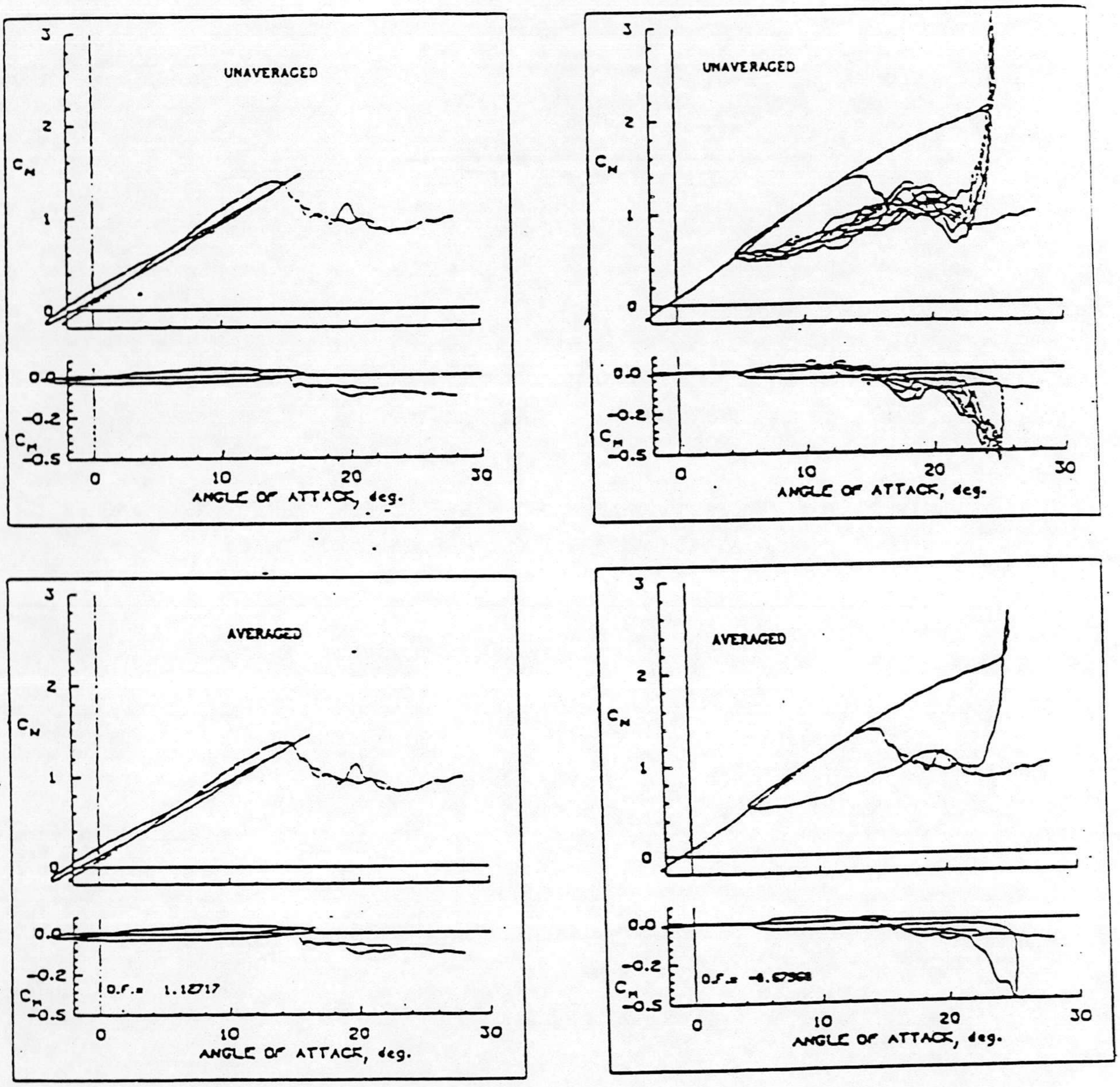


FIGURE 9: EFFECT OF AVERAGING ON THE NORMAL FORCE AND PITCHING MOMENT FOR OSCILLATORY TESTS.

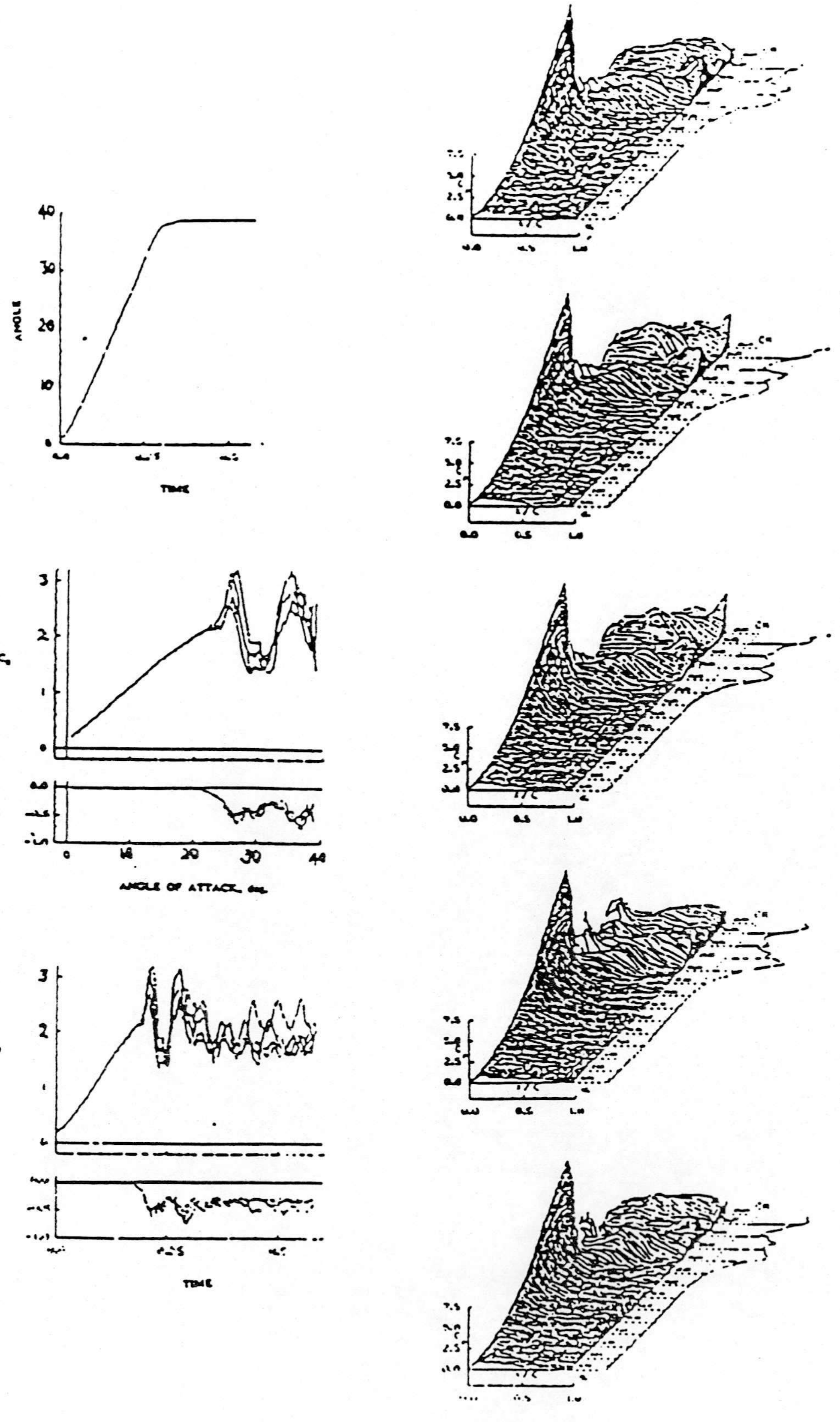


FIGURE 10: TYPICAL UNAVERAGED DATA FOR RAMP TESTS.

G.U. Aero Report 9219

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

PRESSURE DATA FROM

STATIC EXPERIMENTS

DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 11

REYNOLDS NUMBER = 1510273.

DYNAMIC PRESSURE = 977.10 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

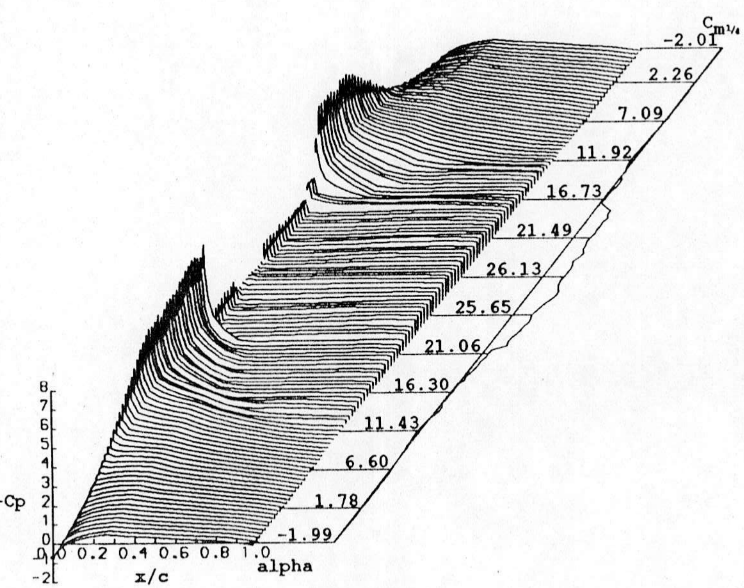
DATE OF TEST: 25/2/92

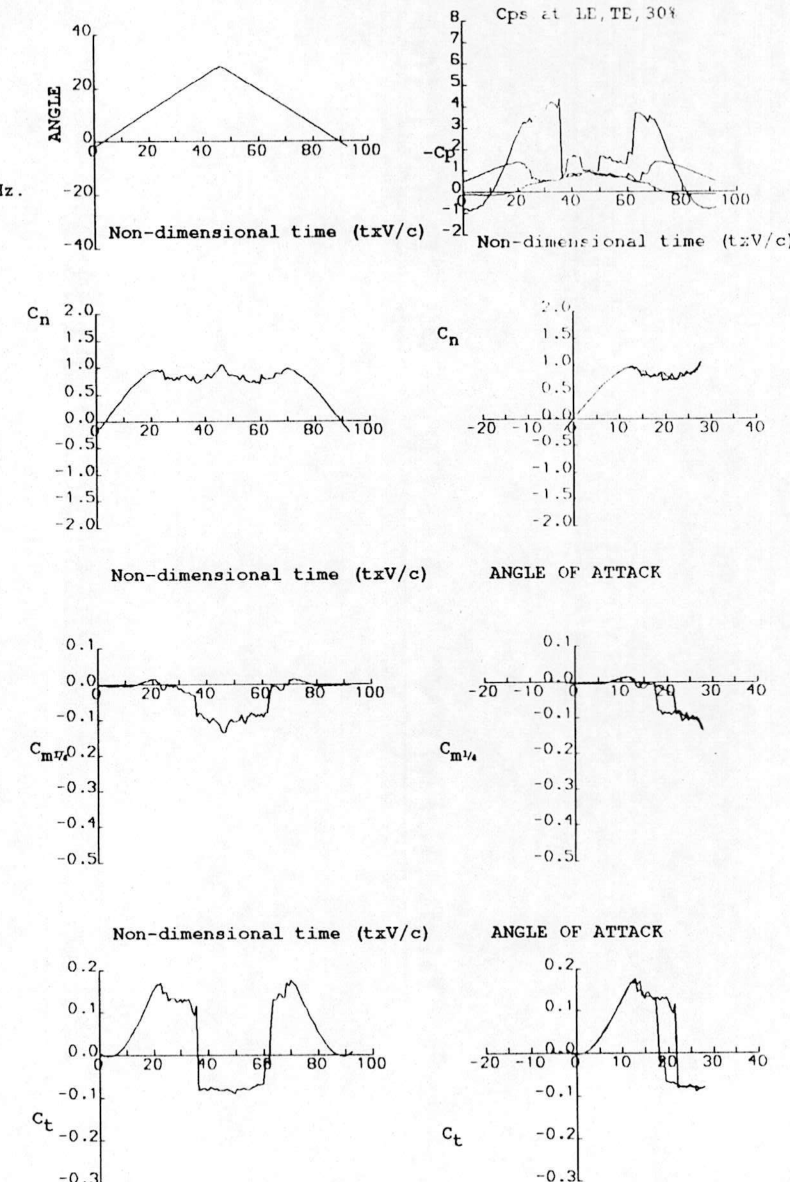
MACH NUMBER = 0.117

AIR TEMPERATURE = 18.2°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 741

REYNOLDS NUMBER = 1040574.

DYNAMIC PRESSURE = 451.28 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

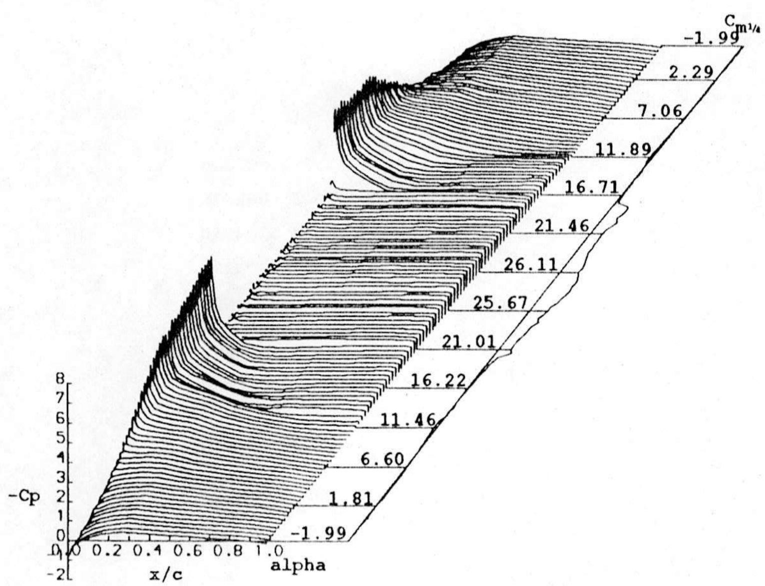
DATE OF TEST: 26/2/92

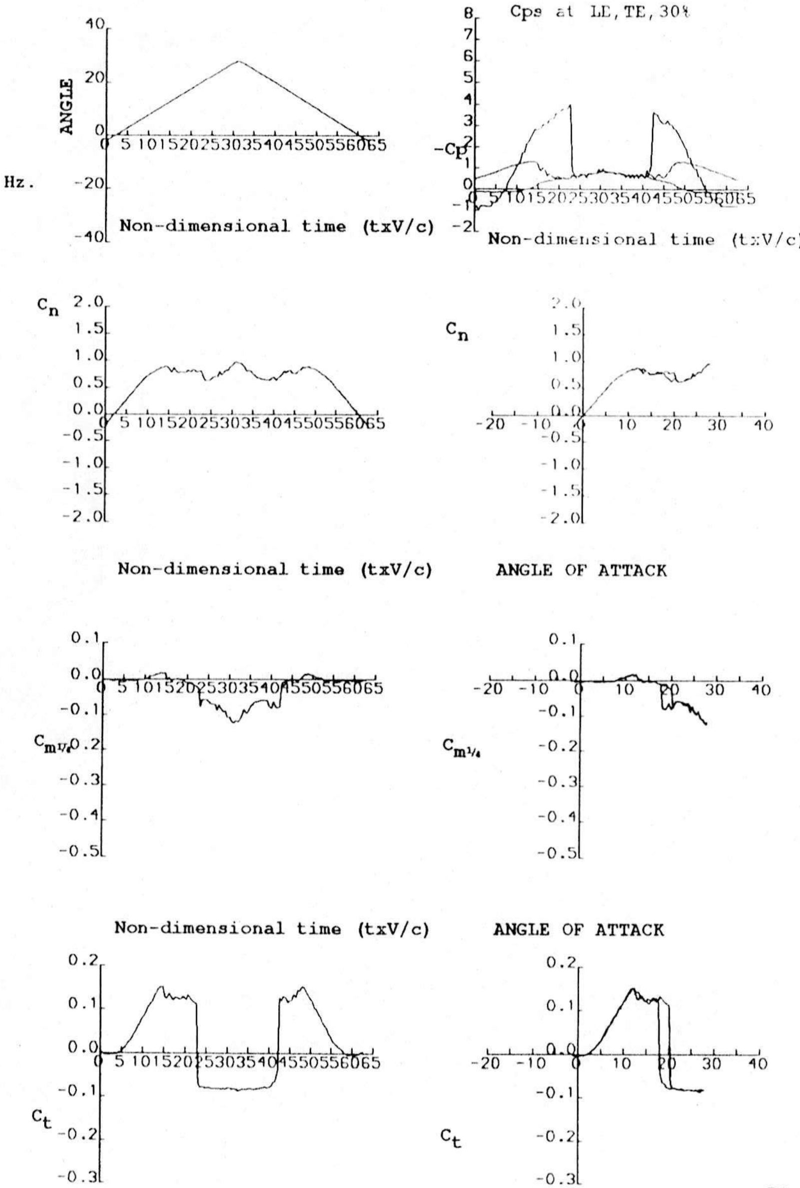
MACH NUMBER = 0.080

AIR TEMPERATURE = 14.3°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 831

REYNOLDS NUMBER = 2068391.

DYNAMIC PRESSURE = 1855.85 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

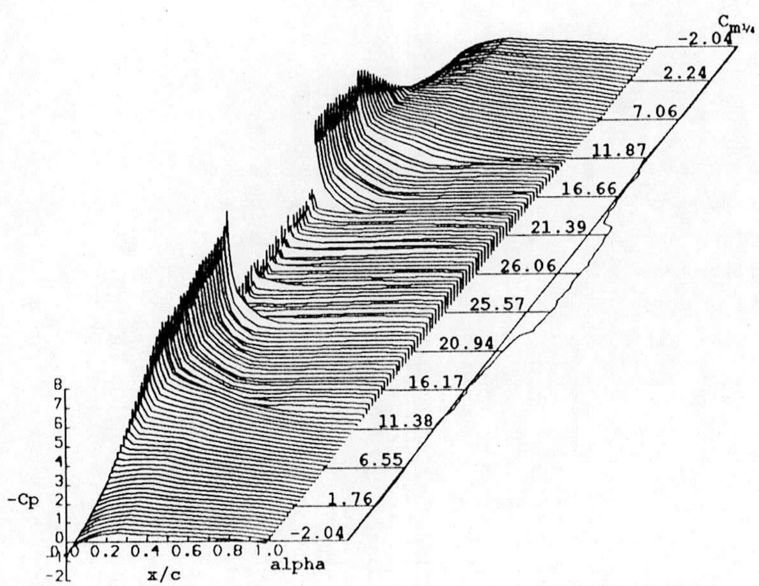
DATE OF TEST: 26/2/92

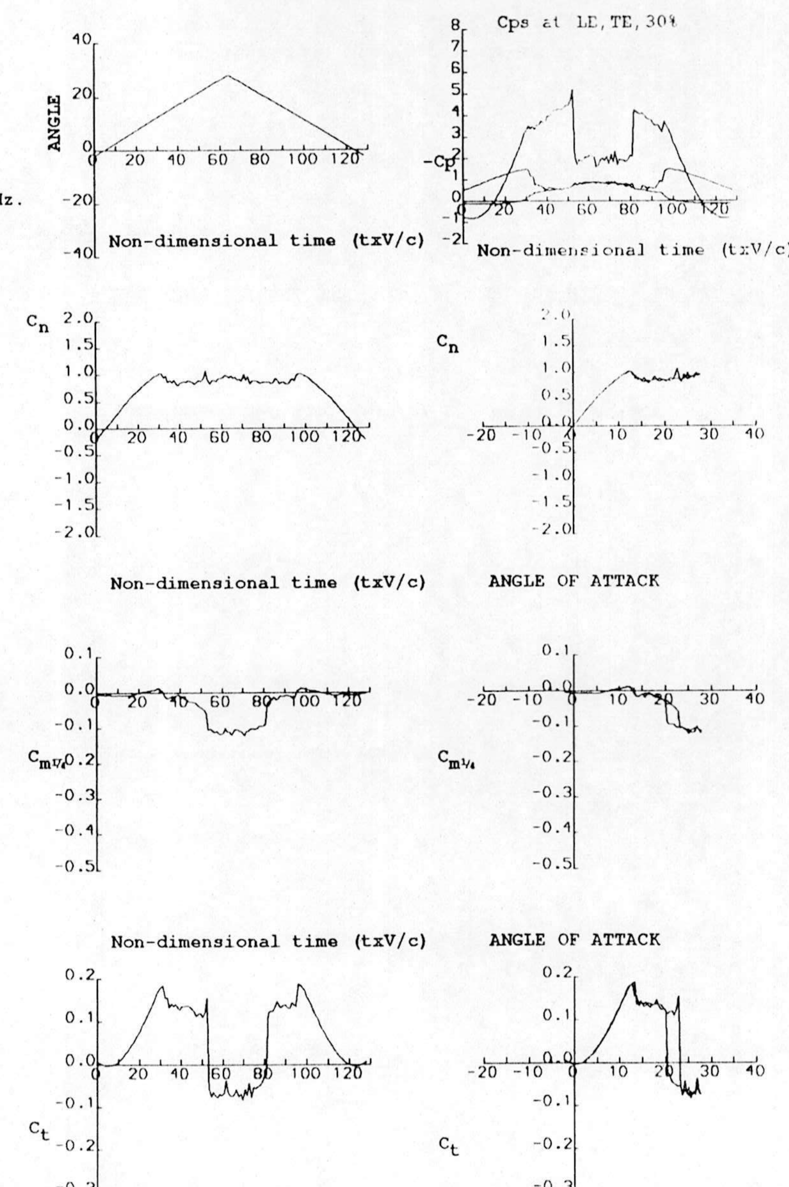
MACH NUMBER = 0.162

AIR TEMPERATURE = 18.8°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES

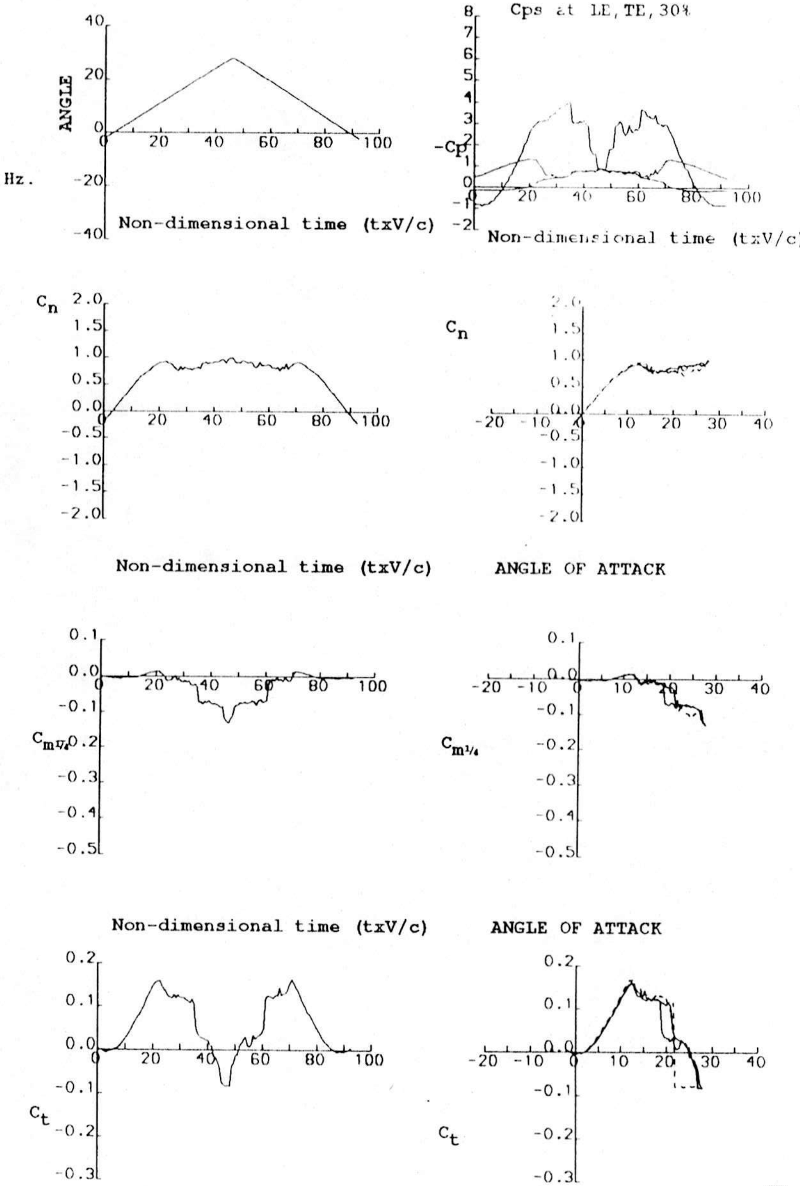


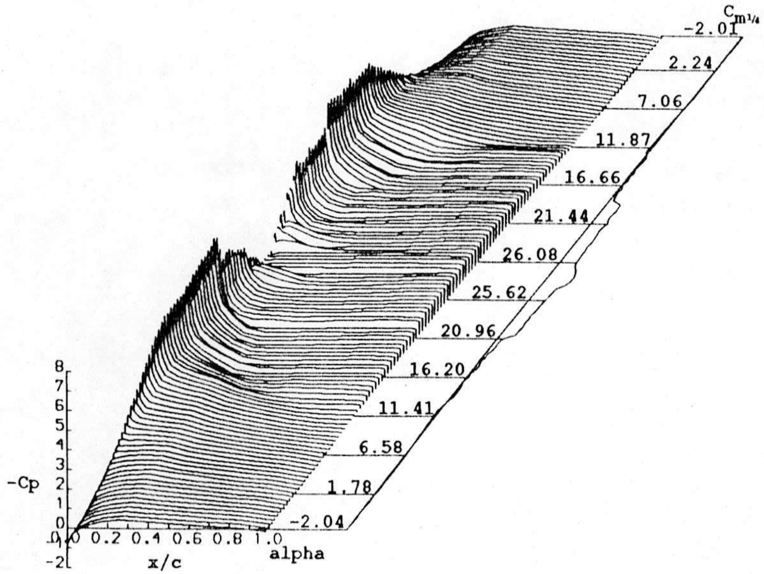


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 921
REYNOLDS NUMBER = 1427707.
DYNAMIC PRESSURE = 943.44 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

DATE OF TEST: 26/2/92
MACH NUMBER = 0.116
AIR TEMPERATURE = 26.5°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 1681

REYNOLDS NUMBER = 1536178.

DYNAMIC PRESSURE = 983.62 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

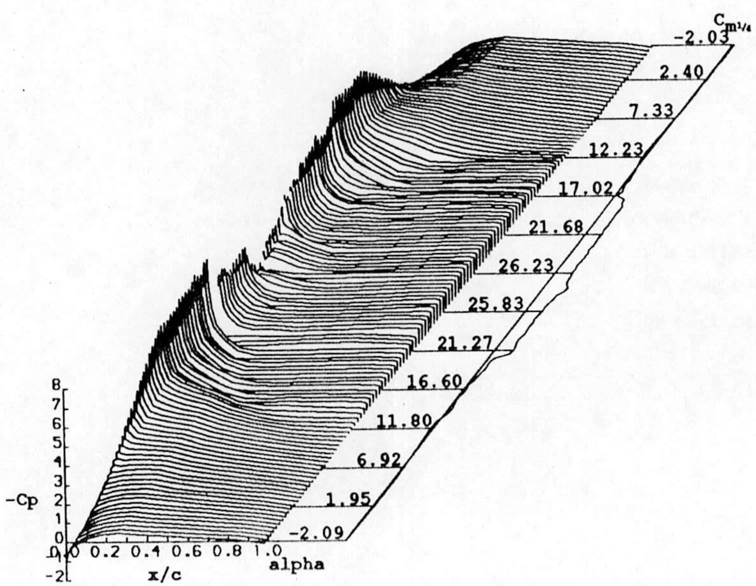
DATE OF TEST: 28/2/92

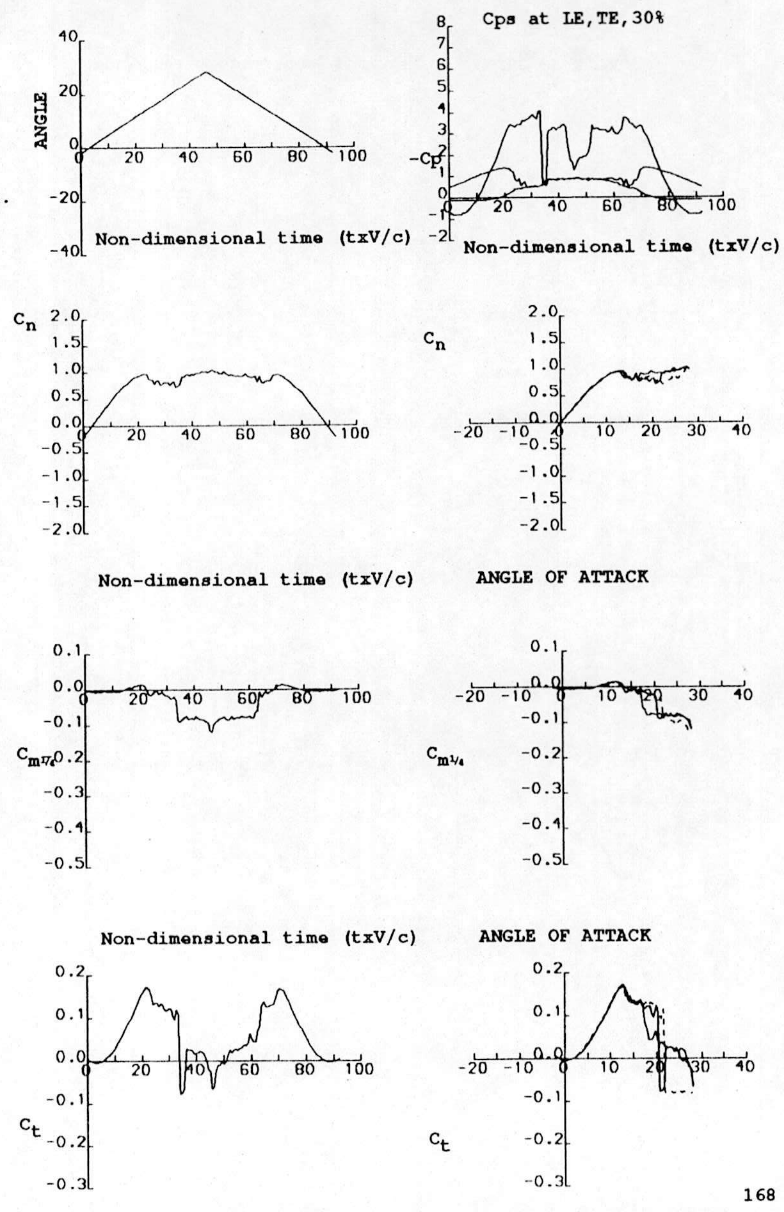
MACH NUMBER = 0.117

AIR TEMPERATURE = 16.0°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 2311

REYNOLDS NUMBER = 1559366.

DYNAMIC PRESSURE = 993.45 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

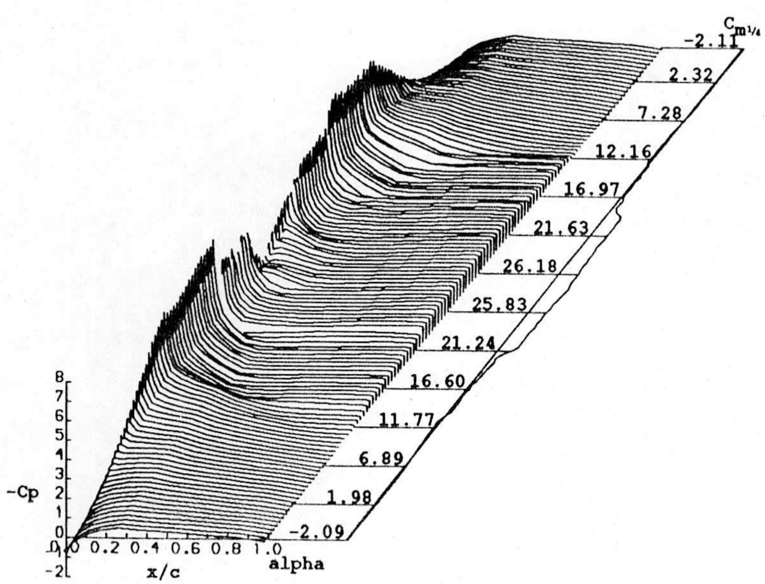
DATE OF TEST: 2/3/92

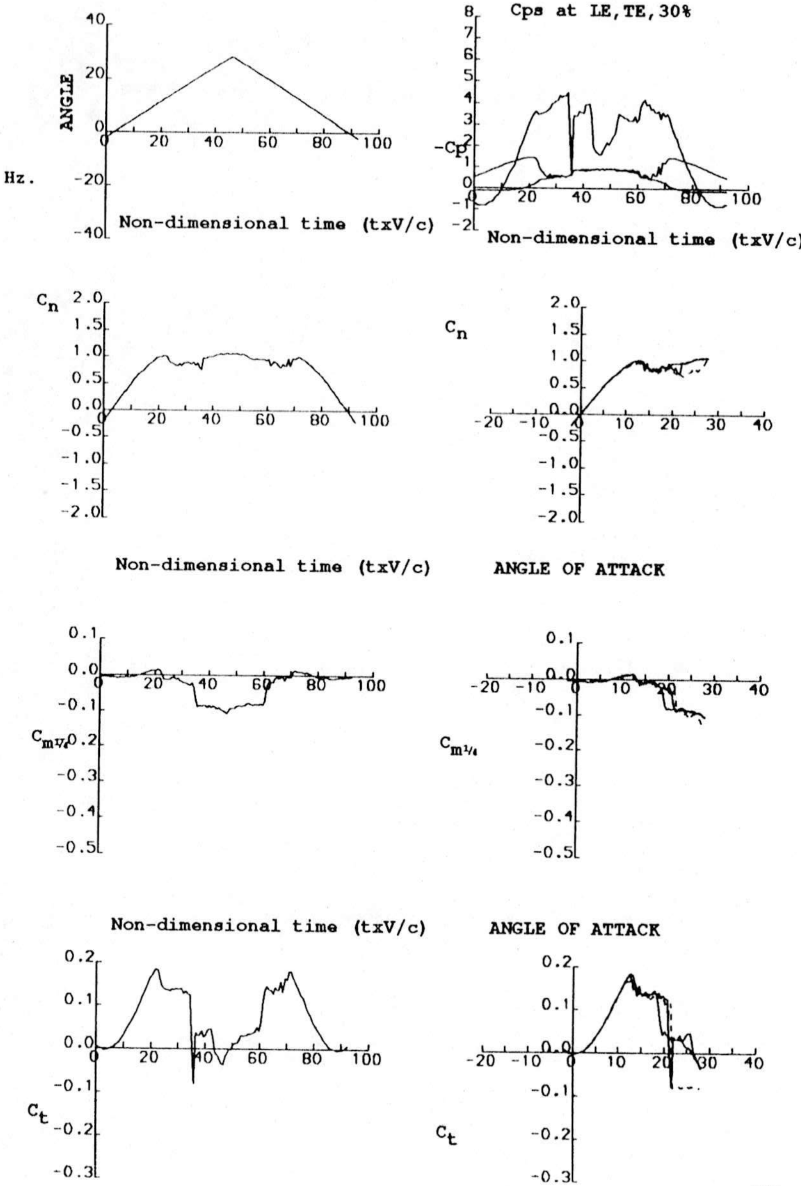
MACH NUMBER = 0.118

AIR TEMPERATURE = 12.6°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 3471

REYNOLDS NUMBER = 1555438.

DYNAMIC PRESSURE = 1009.16 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

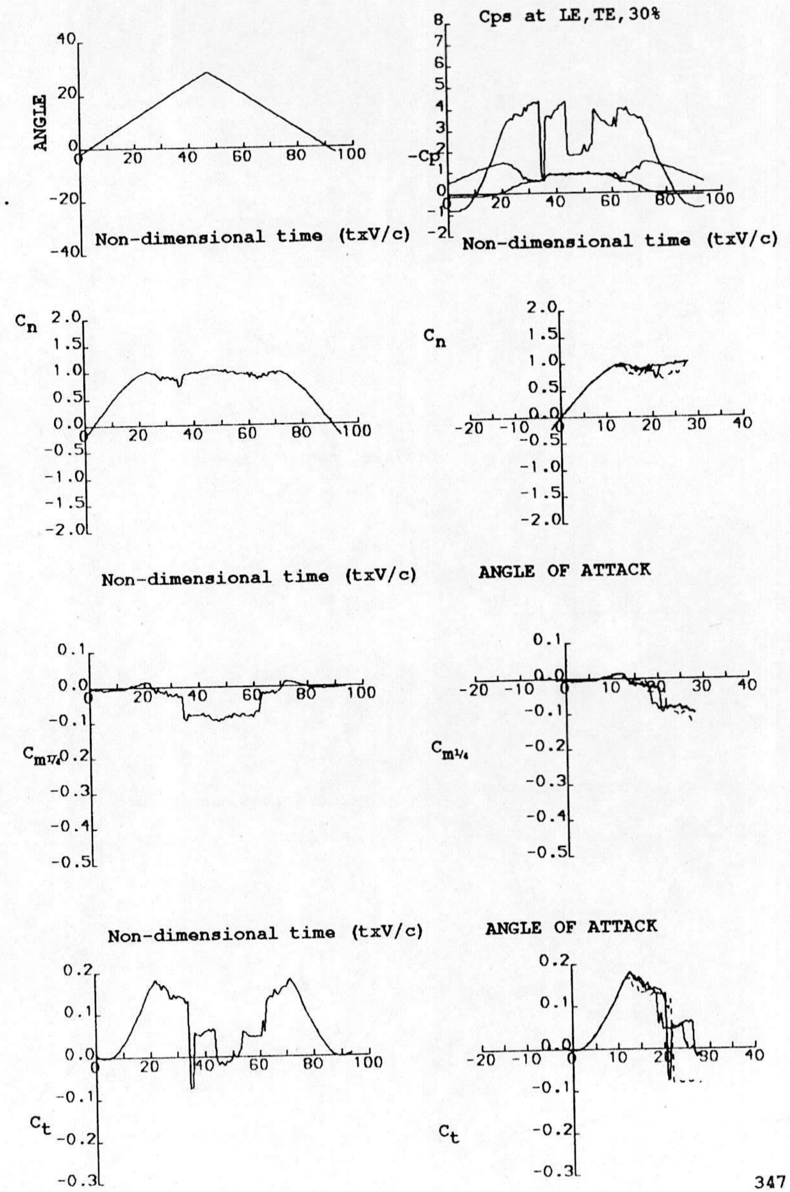
DATE OF TEST: 3/3/92

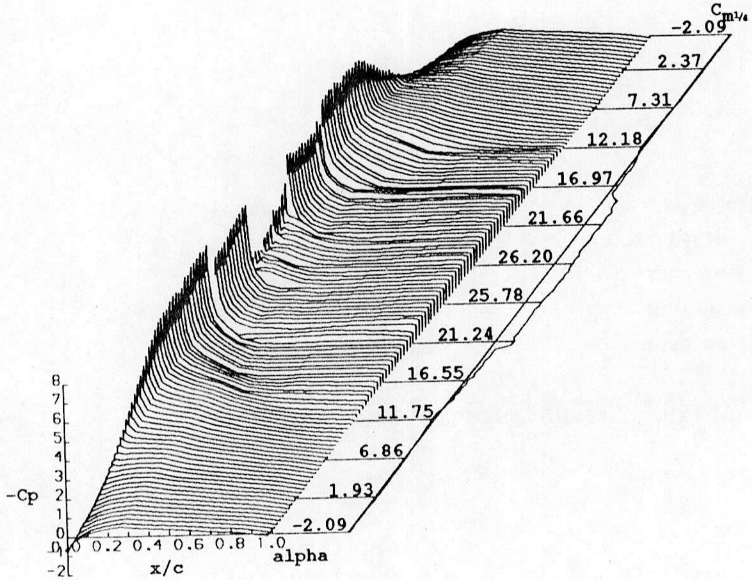
MACH NUMBER = 0.119

AIR TEMPERATURE = 15.2°C

SAMPLING FREQUENCY = 100.00 Hz.

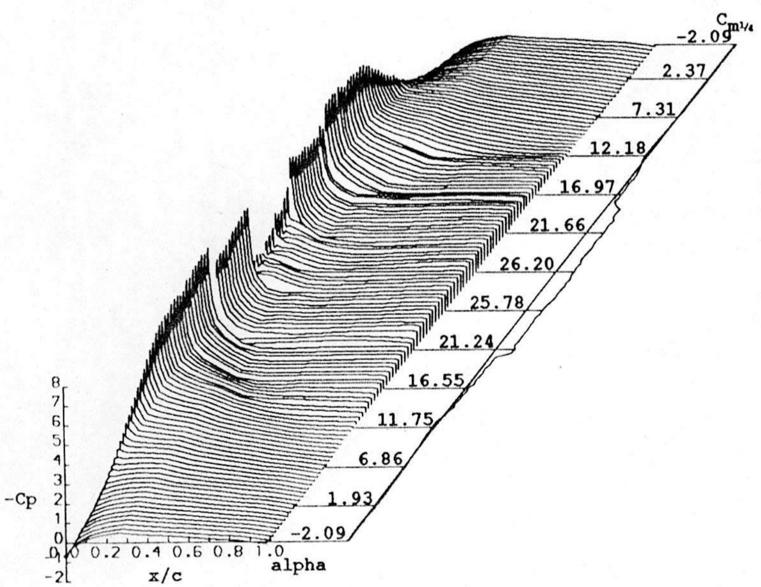
AVERAGED DATA OF 1 CYCLES

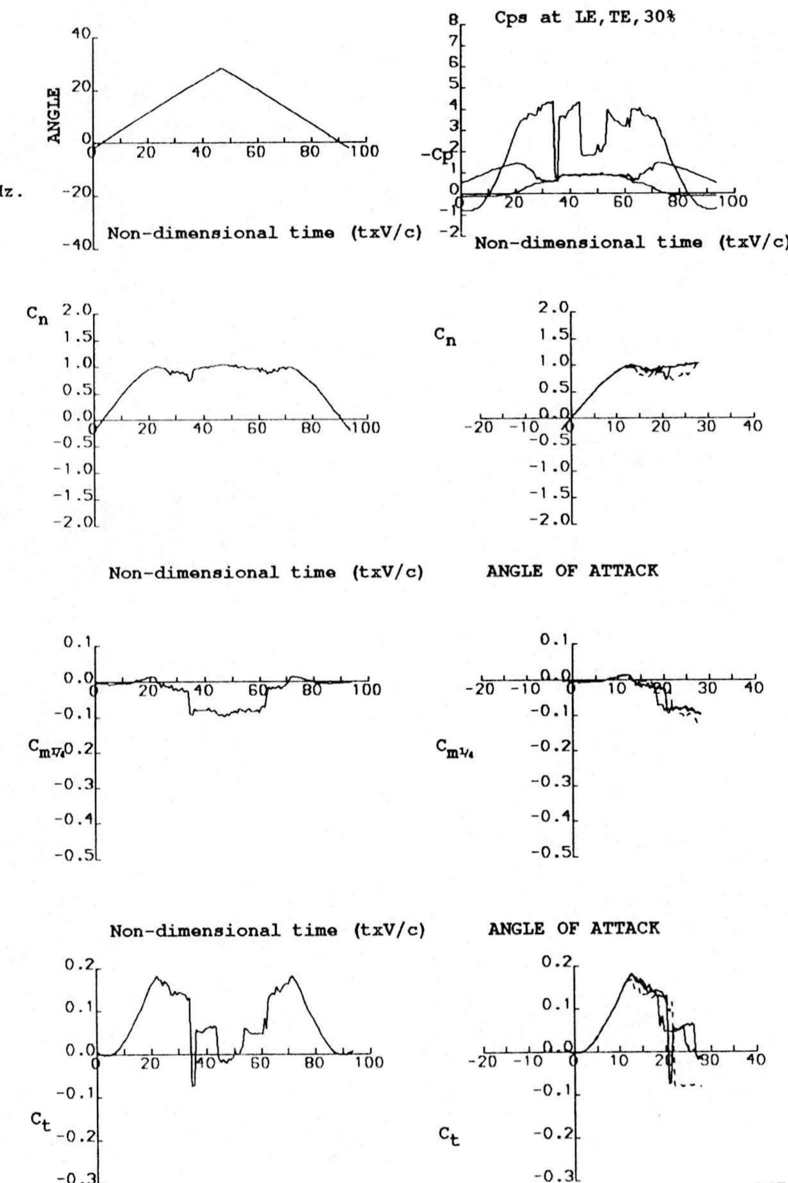




DYNAMIC CHARACTERISTICS FOR THE GUVA10

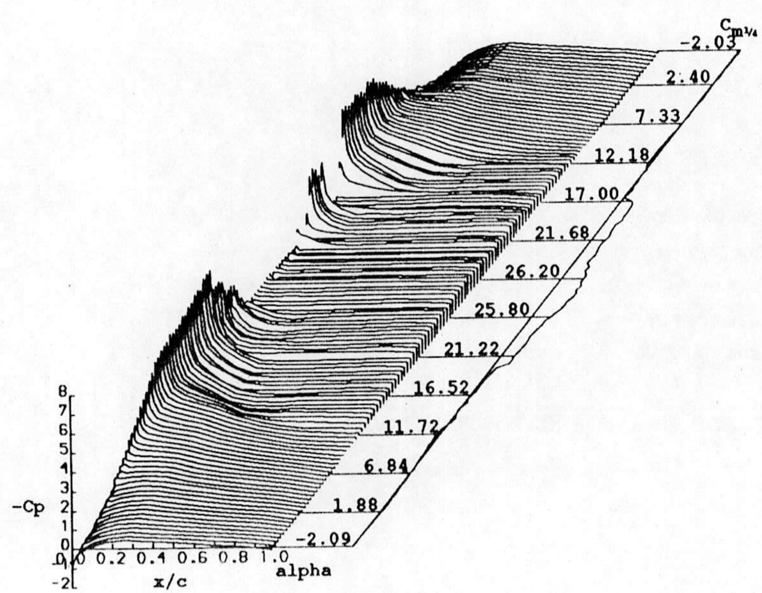
RUN REFERENCE NUMBER: 3471	DATE OF TEST: 3/3/92
REYNOLDS NUMBER = 1555438.	MACH NUMBER = 0.119
DYNAMIC PRESSURE = 1009.16 Nm^{-2}	AIR TEMPERATURE = 15.2°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES

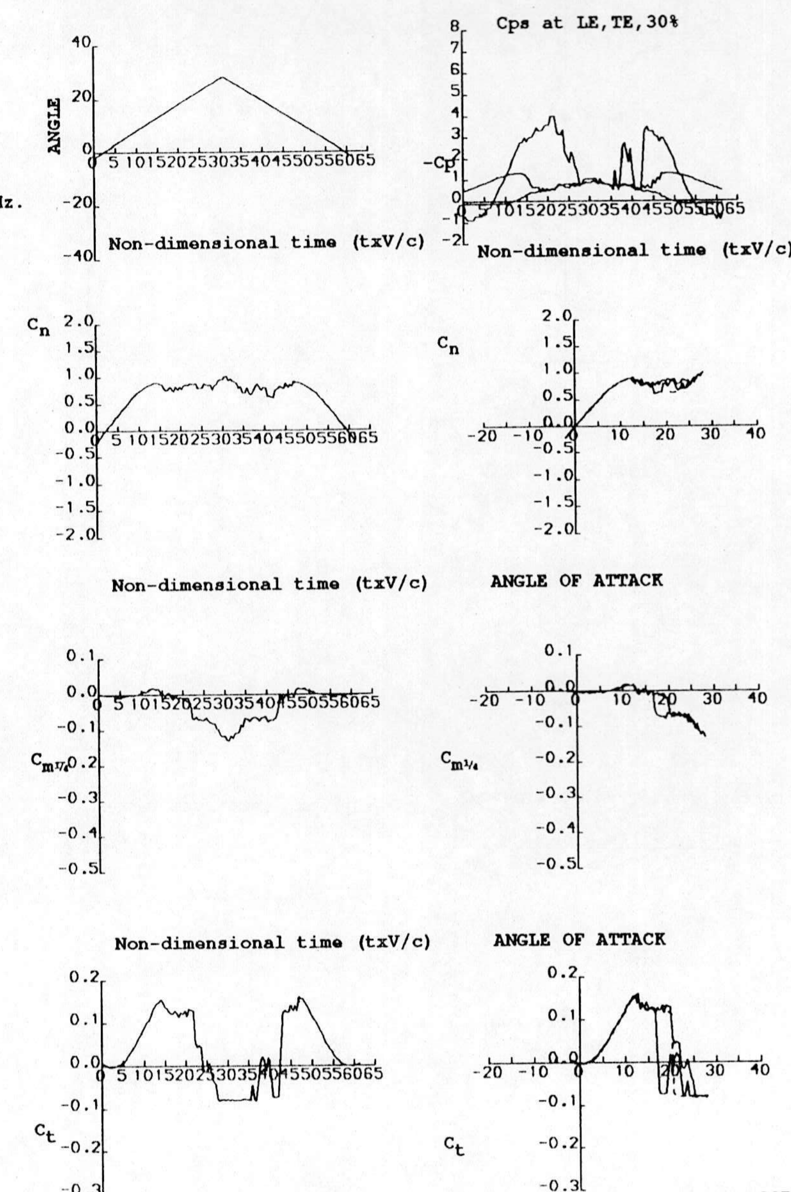




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 3871	DATE OF TEST: 3/3/92
REYNOLDS NUMBER = 988353.	MACH NUMBER = 0.077
DYNAMIC PRESSURE = 427.38 Nm^{-2}	AIR TEMPERATURE = 20.9°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 4041

REYNOLDS NUMBER = 1934279.

DYNAMIC PRESSURE = 1701.98 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

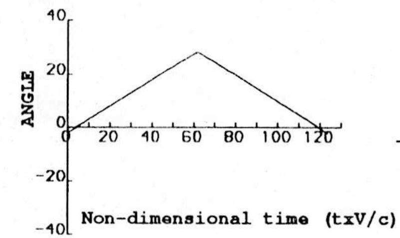
DATE OF TEST: 3/3/92

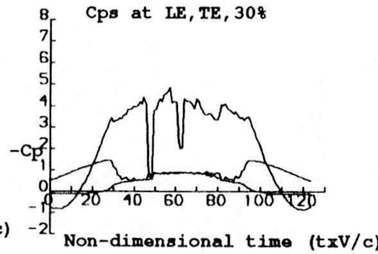
MACH NUMBER = 0.155

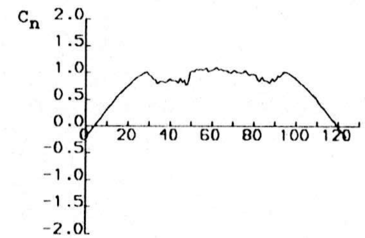
AIR TEMPERATURE = 25.4°C

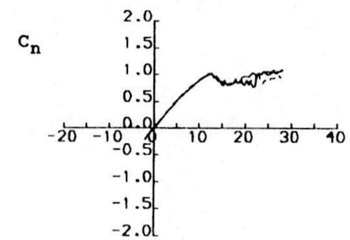
SAMPLING FREQUENCY = 100.00 Hz.

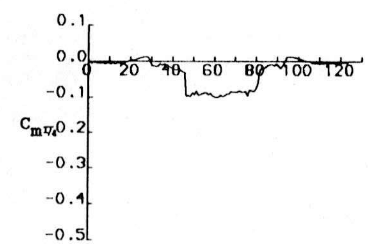
AVERAGED DATA OF 1 CYCLES

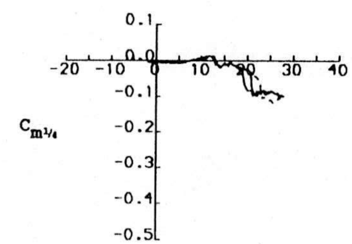


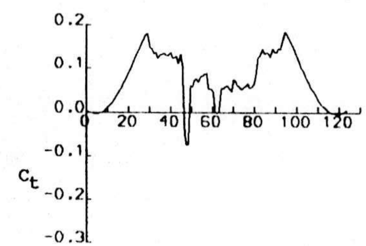


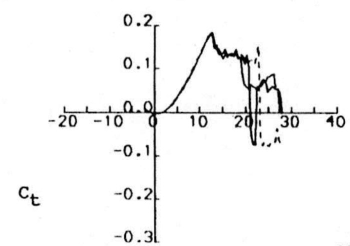


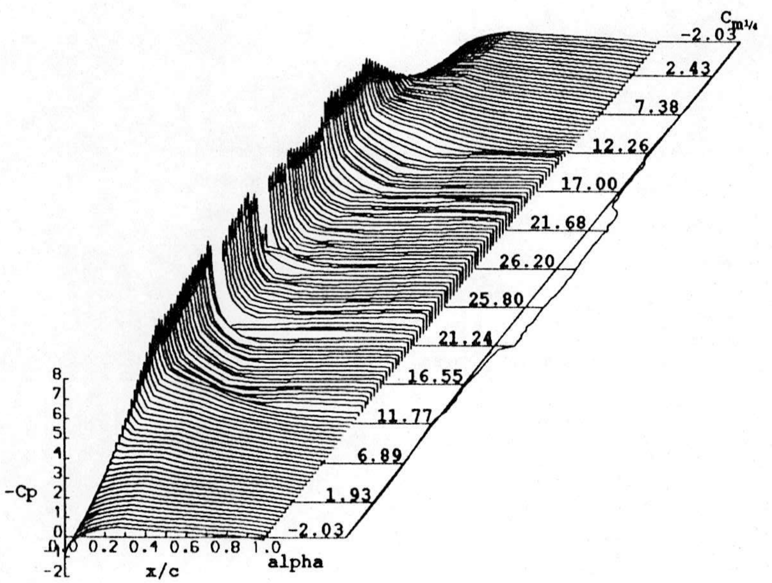












DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 4211

REYNOLDS NUMBER = 1991288.

DYNAMIC PRESSURE = 1706.90 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

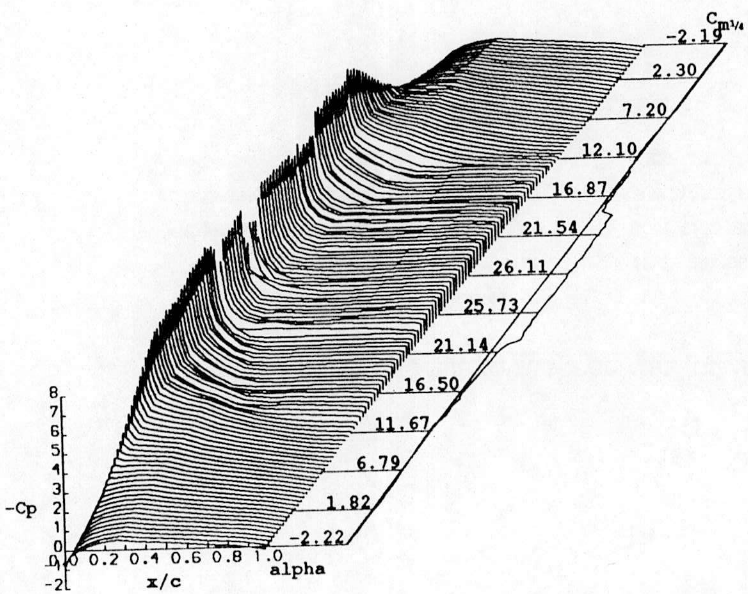
DATE OF TEST: 4/3/92

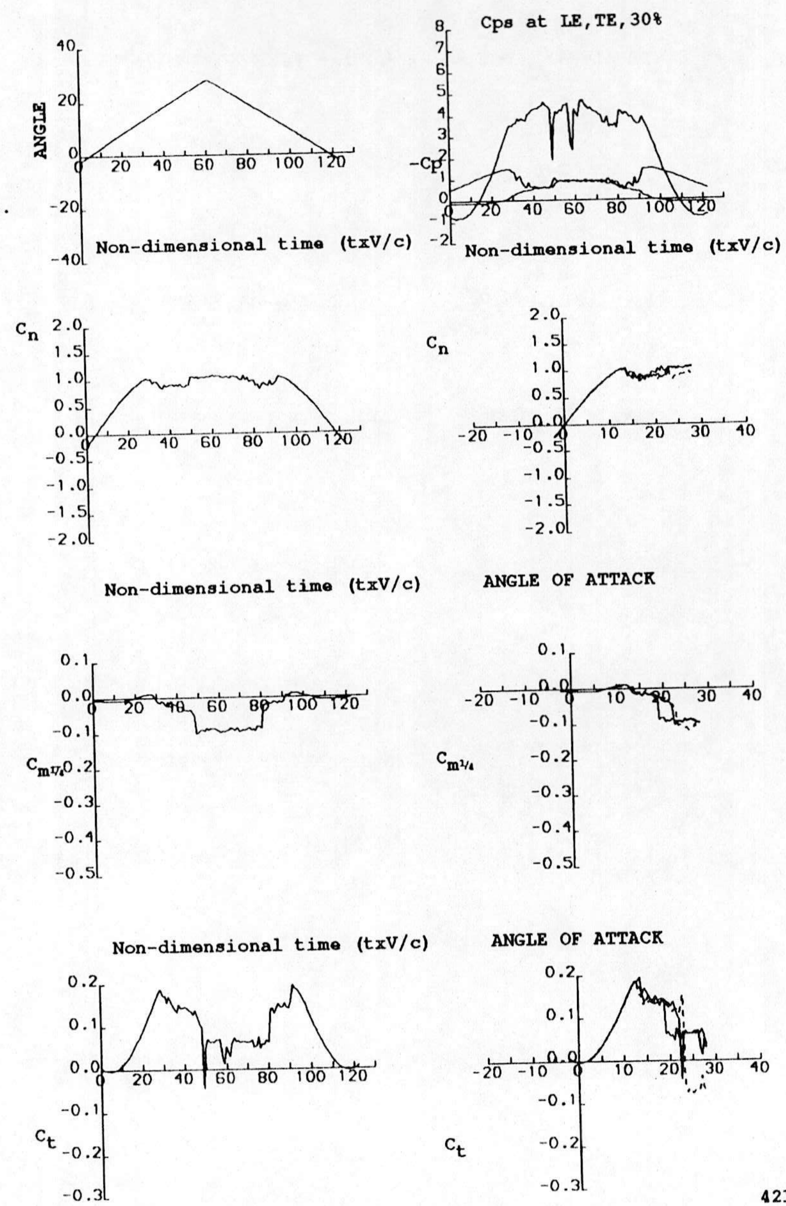
MACH NUMBER = 0.155

AIR TEMPERATURE = 18.9°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 4361

REYNOLDS NUMBER = 1077060.

DYNAMIC PRESSURE = 512.77 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

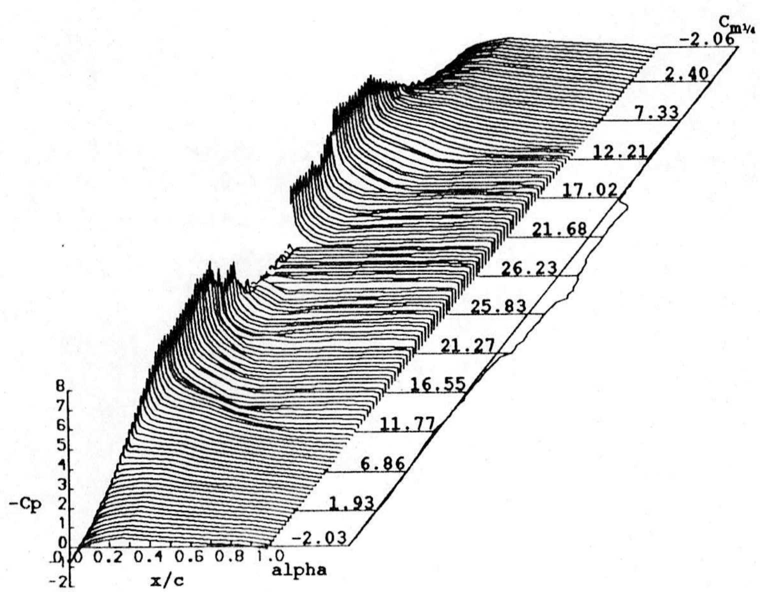
DATE OF TEST: 4/3/92

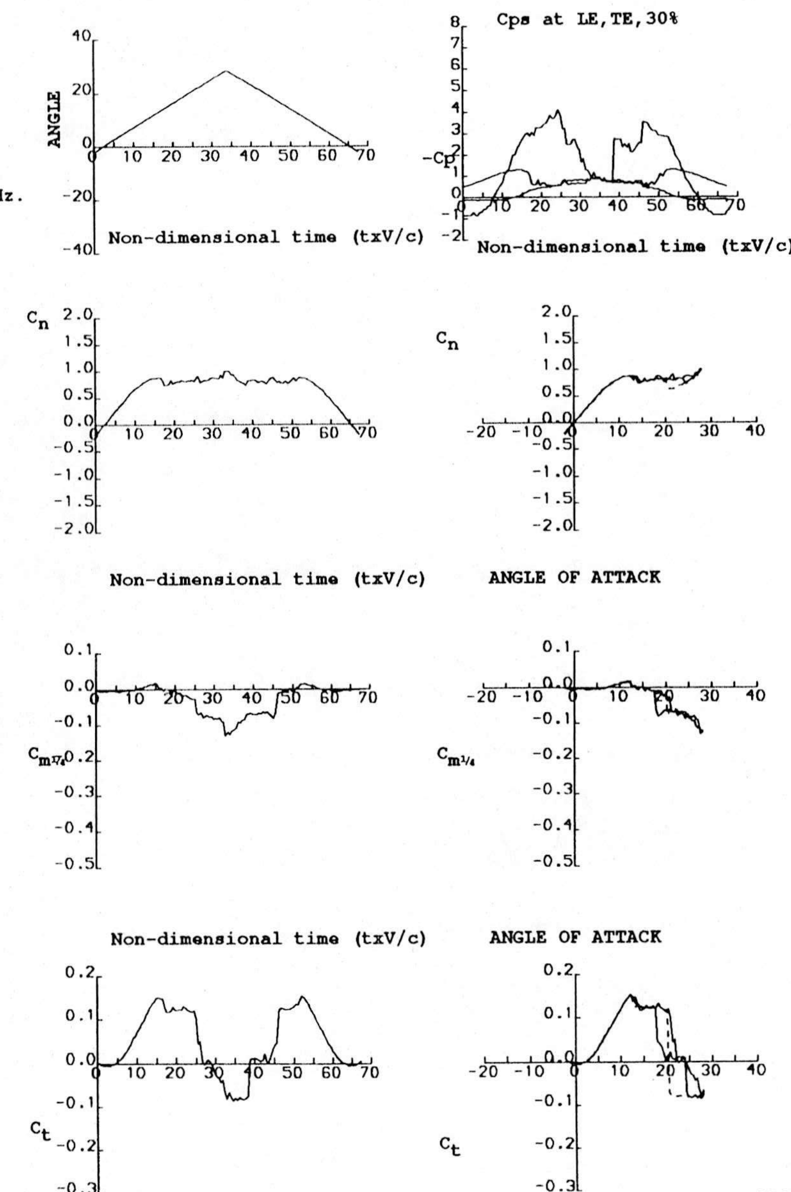
MACH NUMBER = 0.085

AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 4511

REYNOLDS NUMBER = 780269.

DYNAMIC PRESSURE = 270.05 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

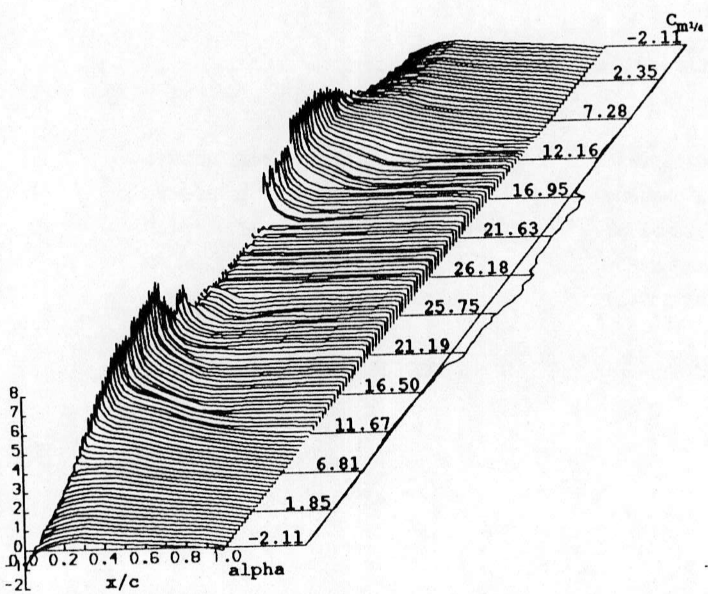
DATE OF TEST: 4/3/92

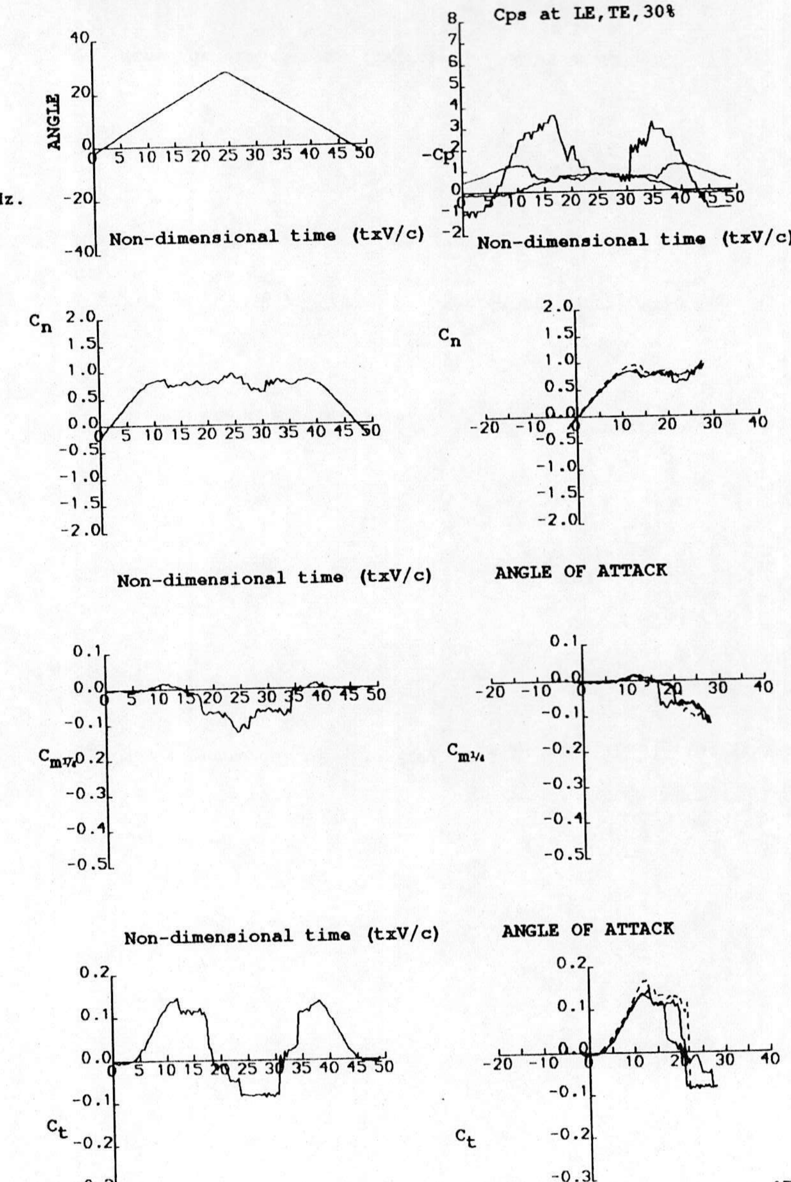
MACH NUMBER = 0.062

AIR TEMPERATURE = 22.4°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 4661

REYNOLDS NUMBER = 1519564.

DYNAMIC PRESSURE = 981.29 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

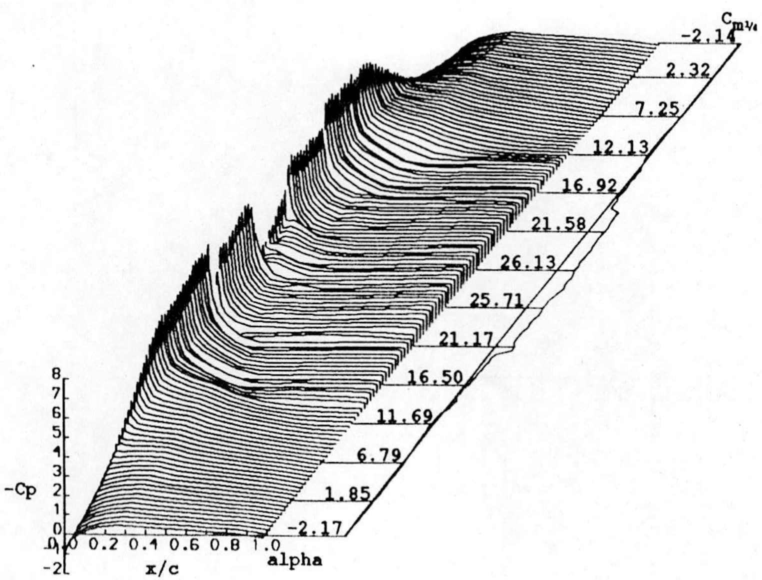
DATE OF TEST: 5/3/92

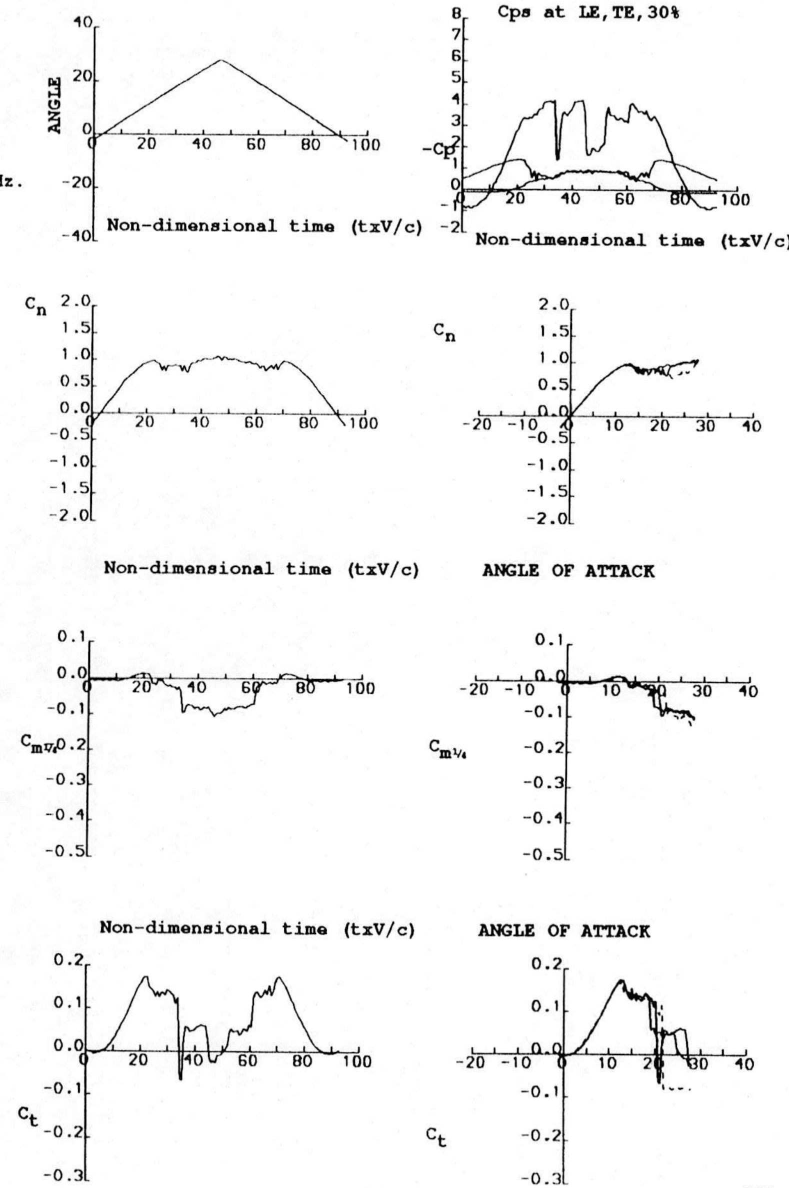
MACH NUMBER = 0.118

AIR TEMPERATURE = 17.0°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 805371

REYNOLDS NUMBER = 1531081.

DYNAMIC PRESSURE = 996.28 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

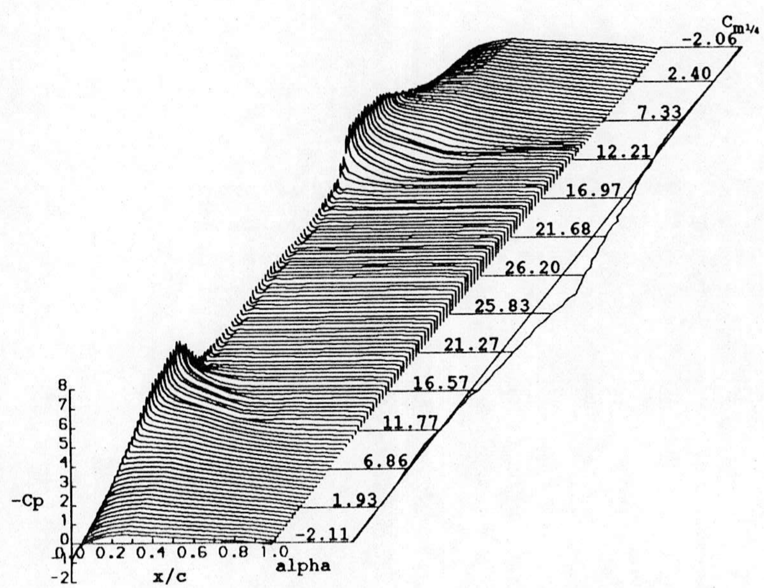
DATE OF TEST: 9/3/92

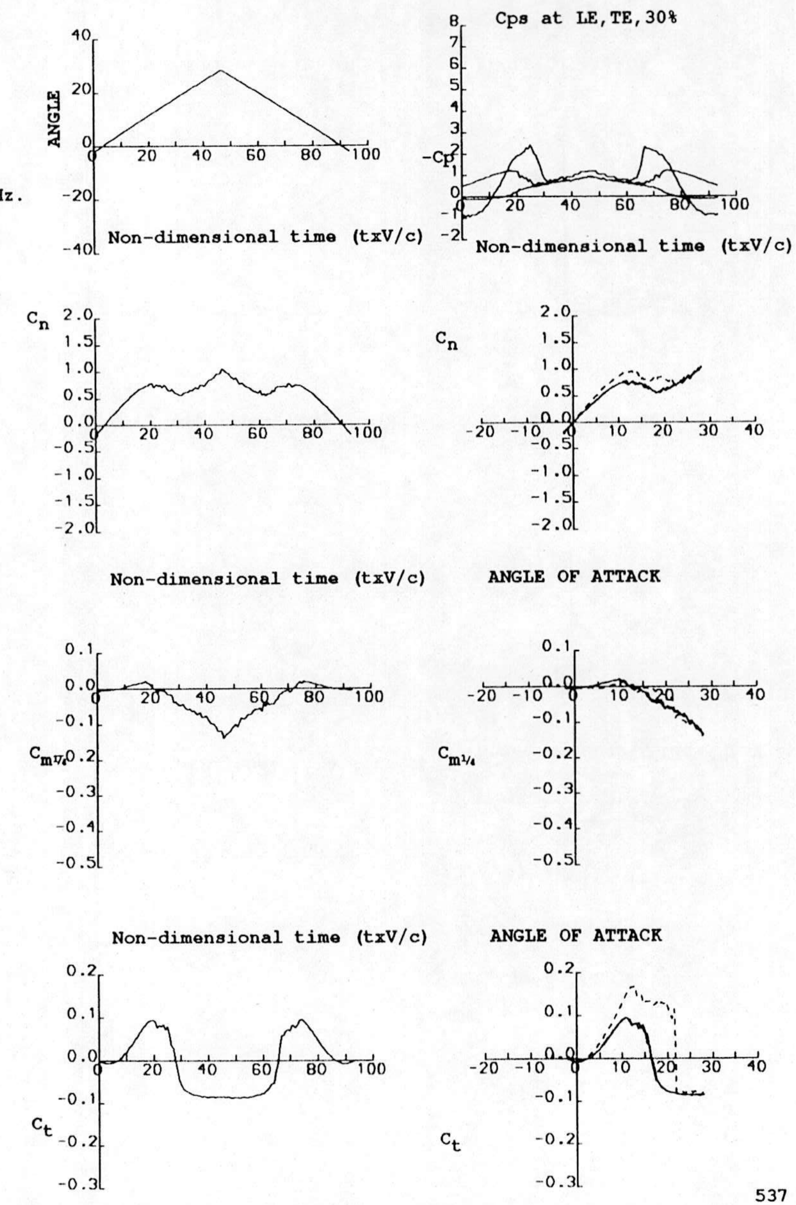
MACH NUMBER = 0.118

AIR TEMPERATURE = 17.6°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 805571

REYNOLDS NUMBER = 1554173.

DYNAMIC PRESSURE = 1000.25 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

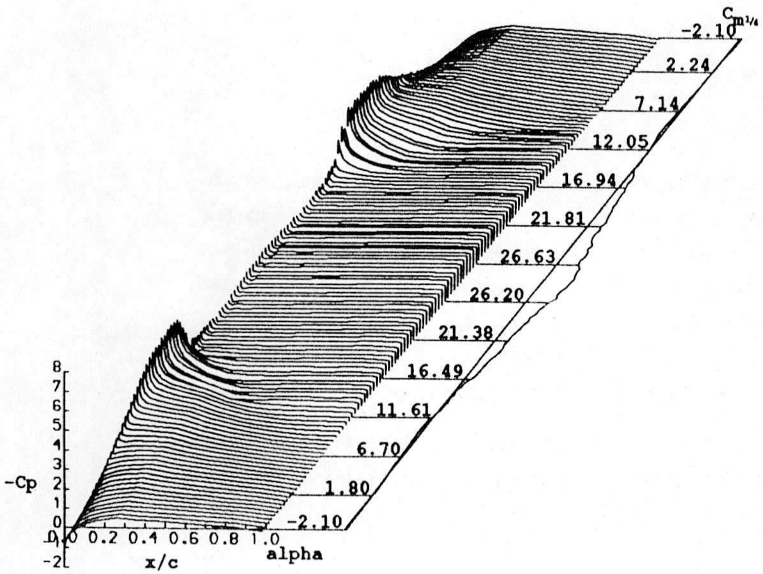
DATE OF TEST: 10/3/92

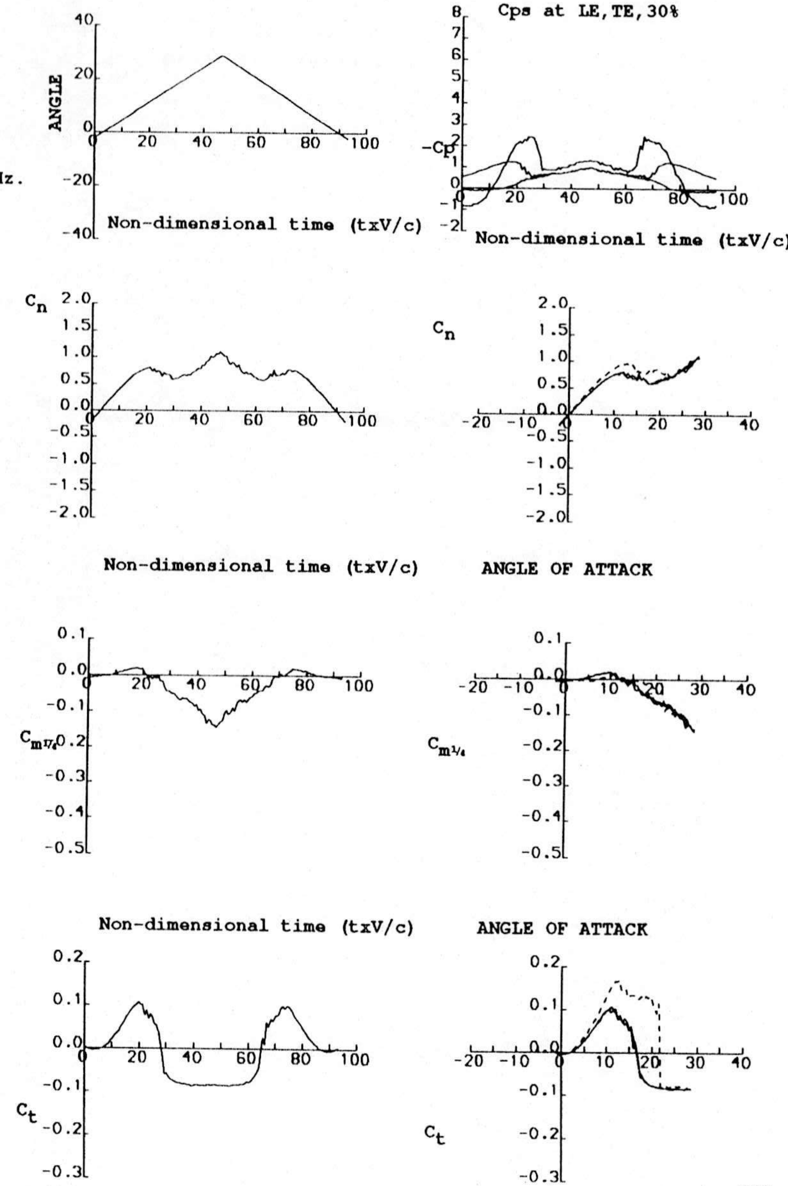
MACH NUMBER = 0.119

AIR TEMPERATURE = 13.4°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 806131

REYNOLDS NUMBER = 1537347.

DYNAMIC PRESSURE = 986.56 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

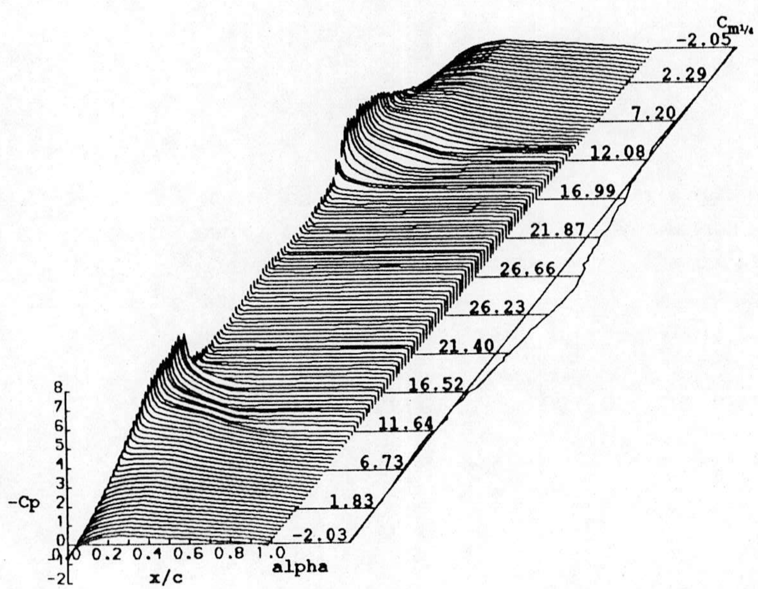
DATE OF TEST: 11/3/92

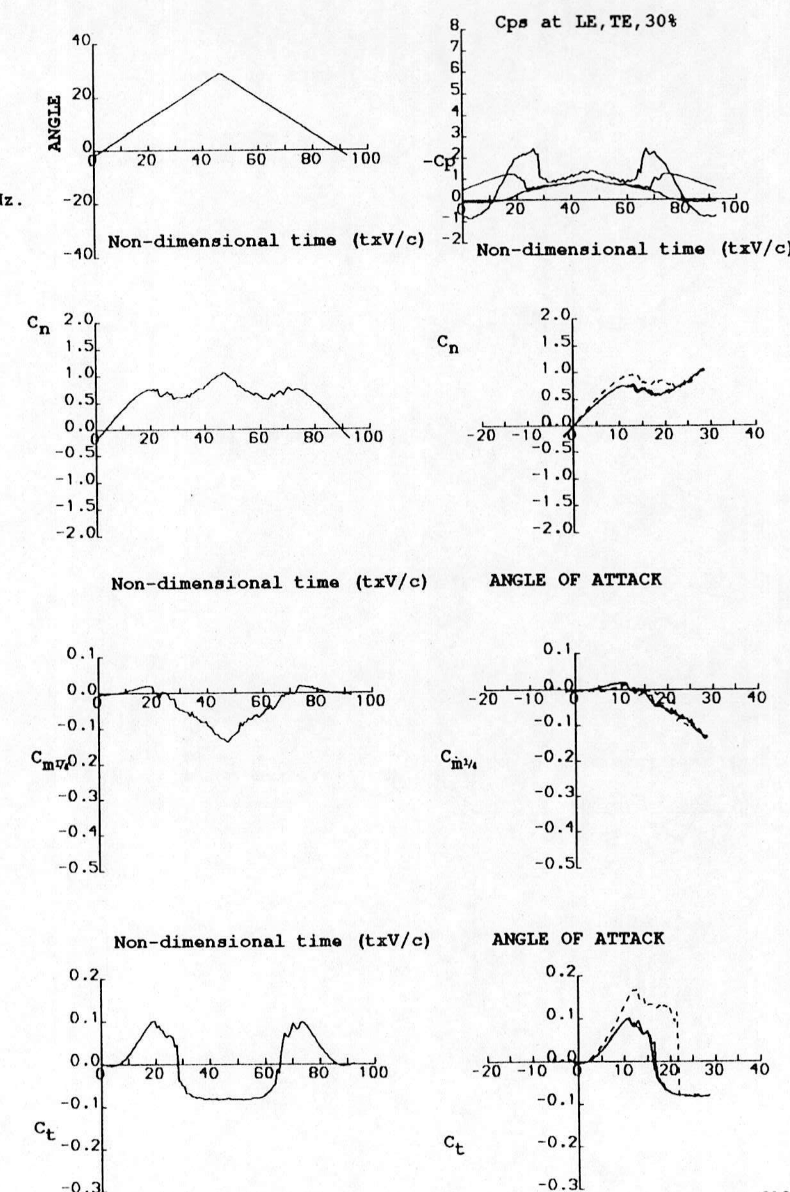
MACH NUMBER = 0.118

AIR TEMPERATURE = 15.1°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





G.U. Aero Report 9219

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

PRESSURE DATA FROM

OSCILLATORY EXPERIMENTS

DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14221

REYNOLDS NUMBER = 1907092.

DYNAMIC PRESSURE = 1692.41 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

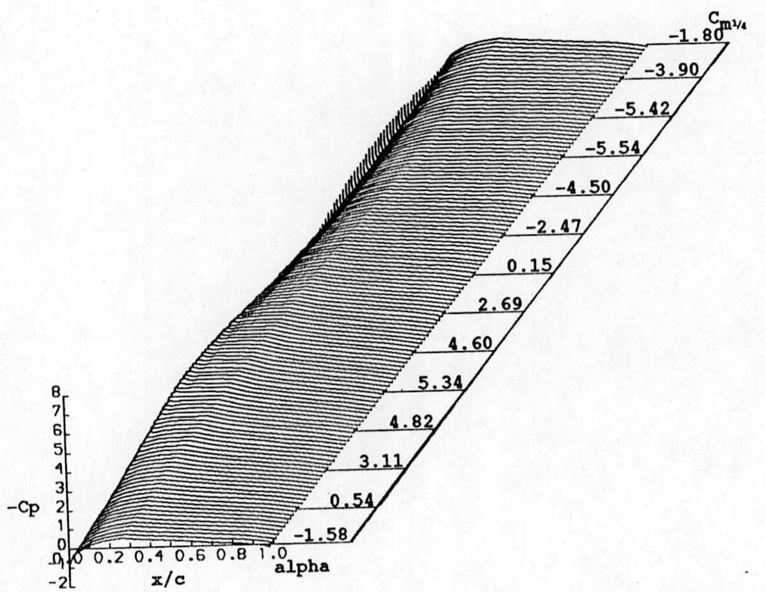
MACH NUMBER = 0.154

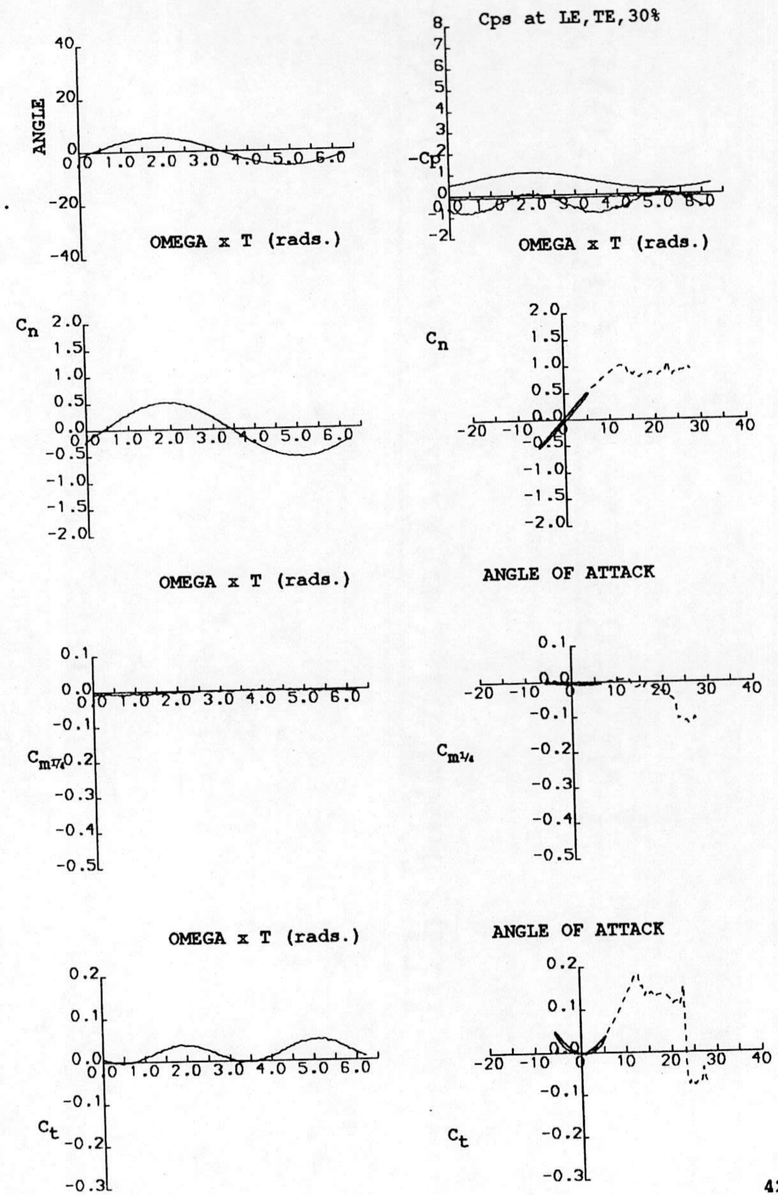
AIR TEMPERATURE = 27.9°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 5.40°

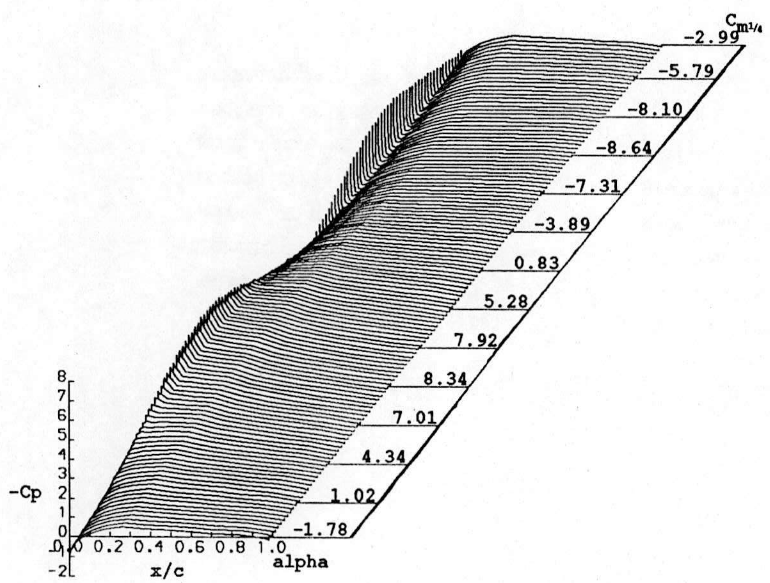


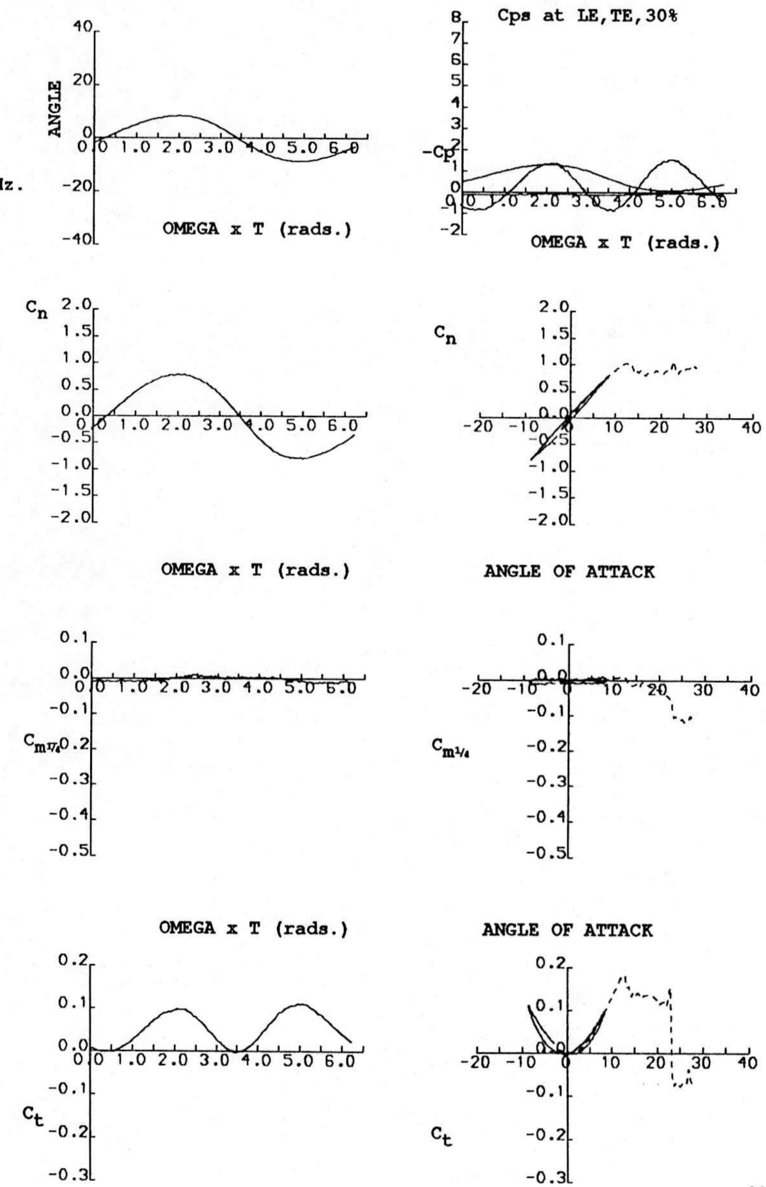


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54291
REYNOLDS NUMBER = 1965594.
DYNAMIC PRESSURE = 1759.84 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.630 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.157
AIR TEMPERATURE = 25.4°C
SAMPLING FREQUENCY = 208.64 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 5.40°

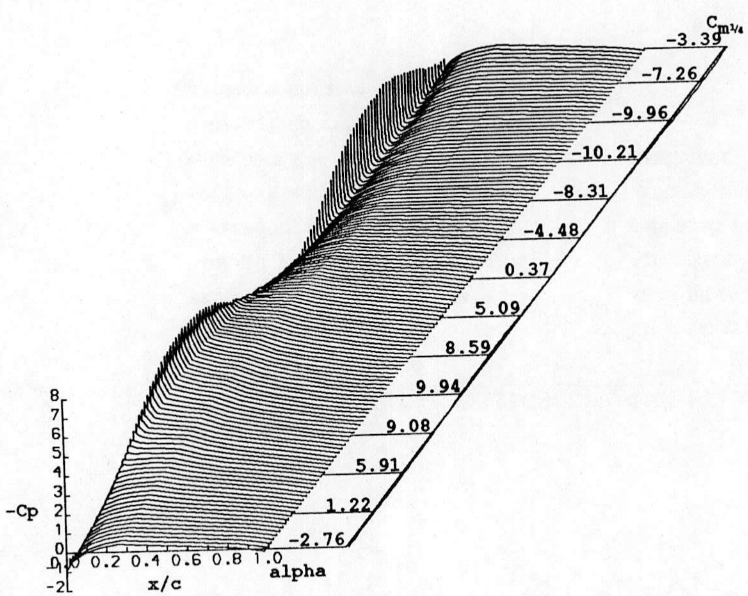


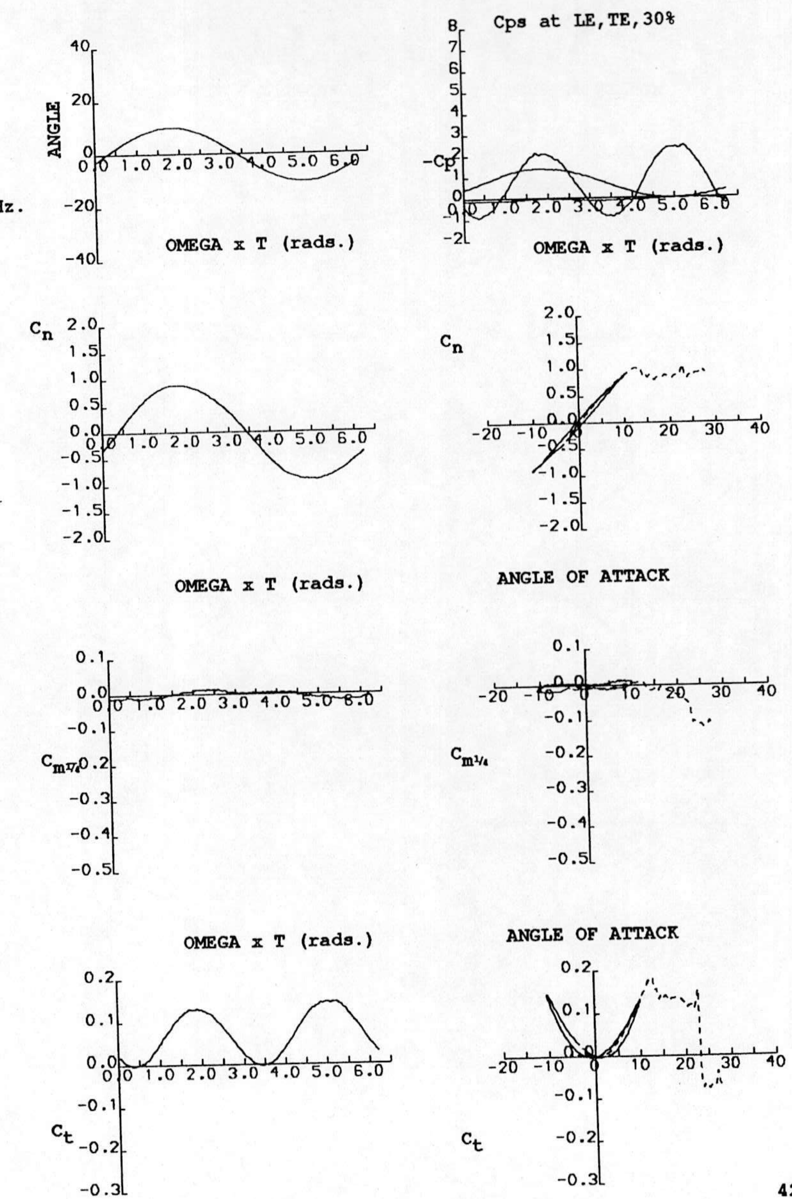


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14231
REYNOLDS NUMBER = 1903047.
DYNAMIC PRESSURE = 1692.41 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.630 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.154
AIR TEMPERATURE = 28.4°C
SAMPLING FREQUENCY = 208.64 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54301

REYNOLDS NUMBER = 1960543.

DYNAMIC PRESSURE = 1759.84 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

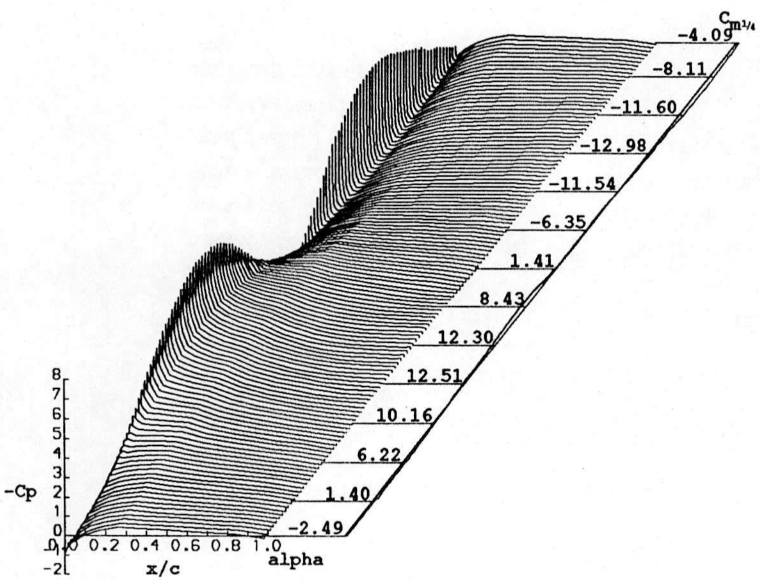
MACH NUMBER = 0.157

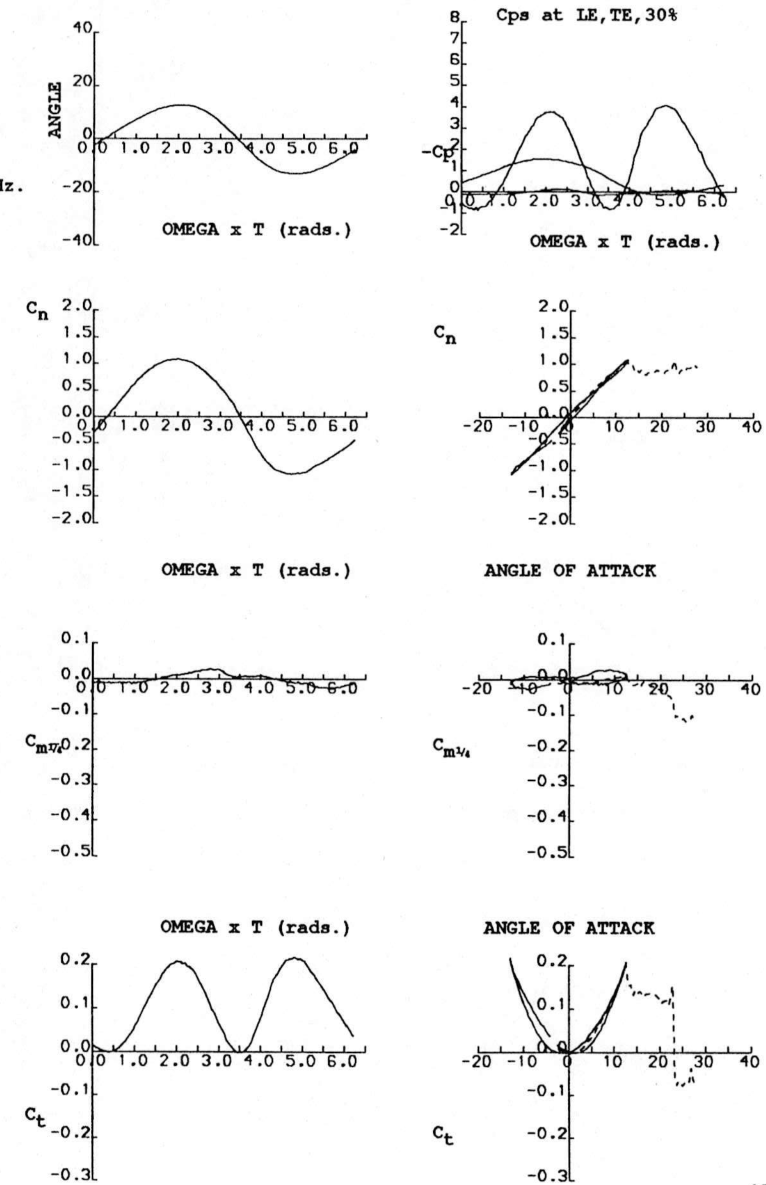
AIR TEMPERATURE = 26.0°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 10.00°

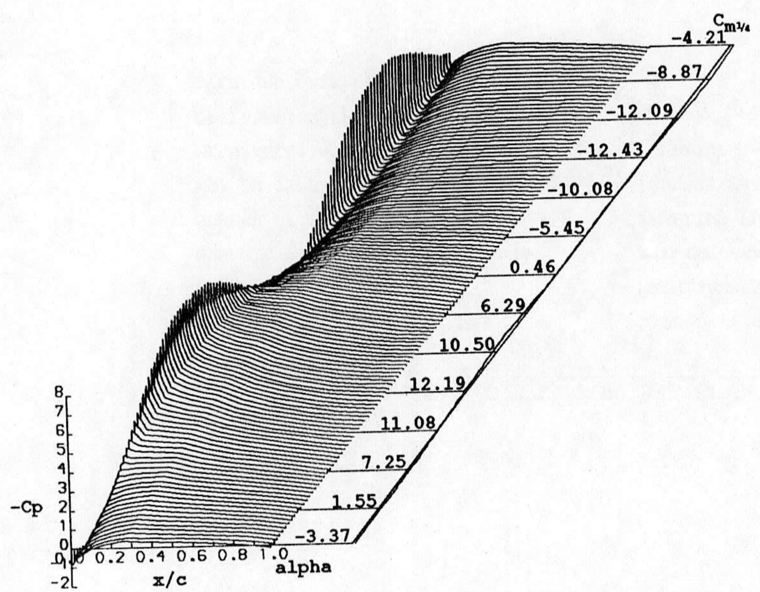


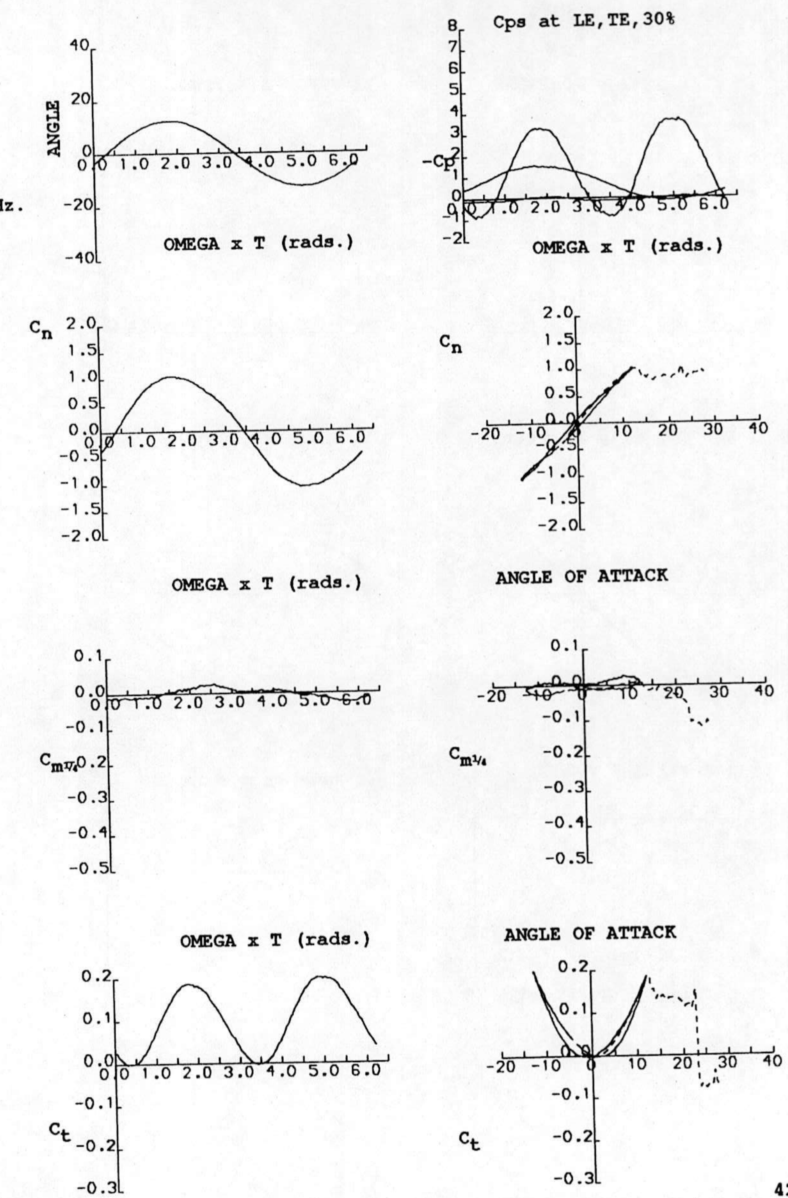


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14241
REYNOLDS NUMBER = 1900627.
DYNAMIC PRESSURE = 1692.41 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.630 Hz.
AVERAGED DATA OF 10 CYCLES

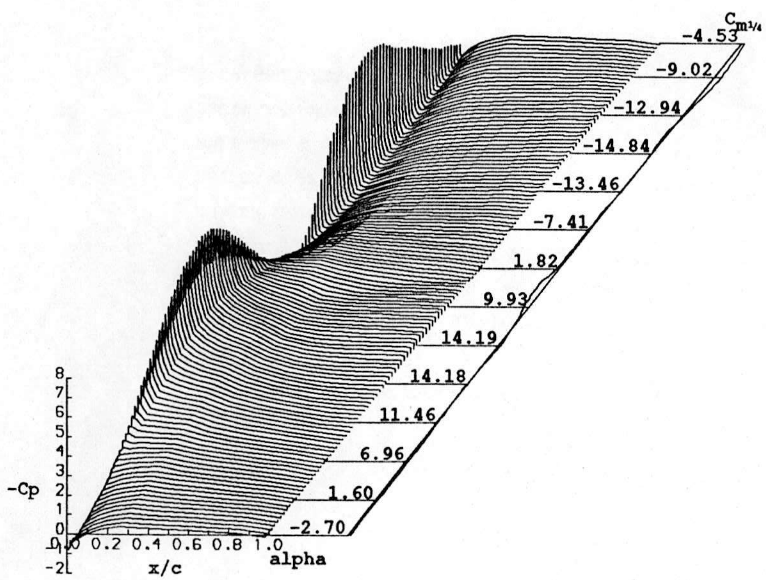
DATE OF TEST: 4/3/92
MACH NUMBER = 0.154
AIR TEMPERATURE = 28.7°C
SAMPLING FREQUENCY = 208.64 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 12.20°

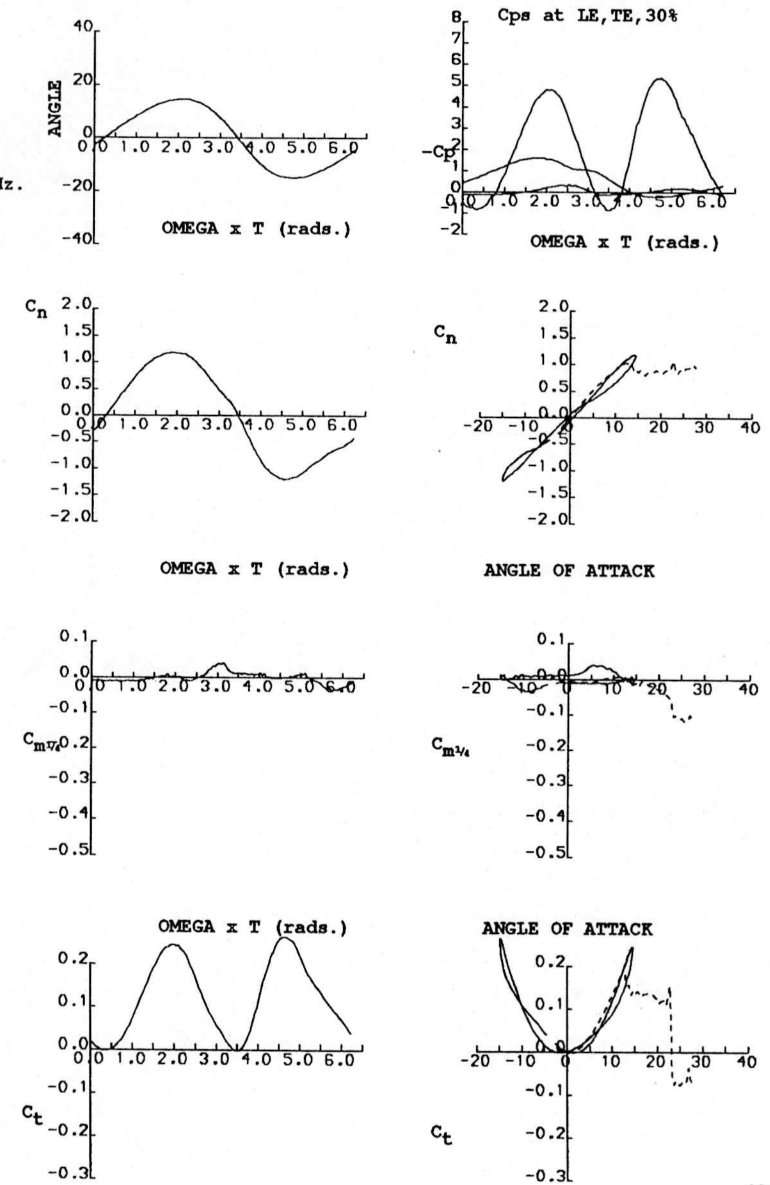




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54311	DATE OF TEST: 4/3/92
REYNOLDS NUMBER = 1956354.	MACH NUMBER = 0.157
DYNAMIC PRESSURE = 1759.84 Nm^{-2}	AIR TEMPERATURE = 26.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 208.64 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.052
MEAN ANGLE = 0.00°	AMPLITUDE = 12.20°
OSCILLATION FREQUENCY = 1.630 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14251

REYNOLDS NUMBER = 1896607.

DYNAMIC PRESSURE = 1692.41 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

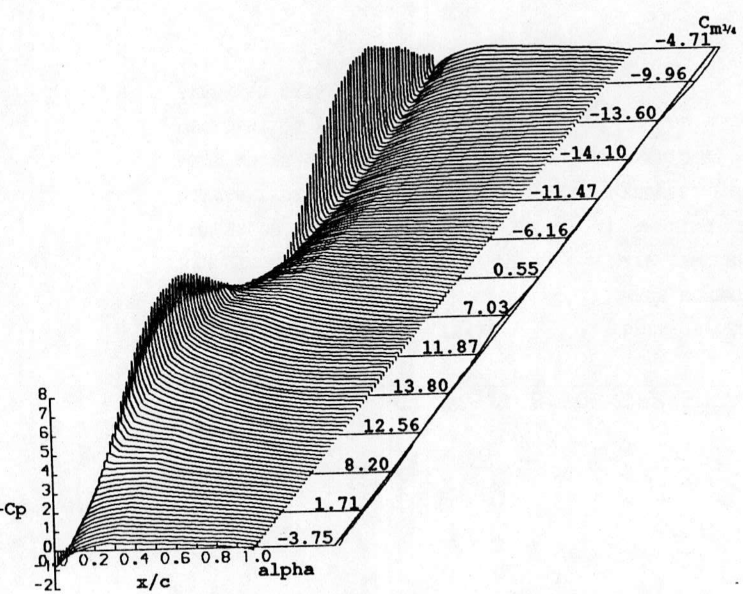
MACH NUMBER = 0.154

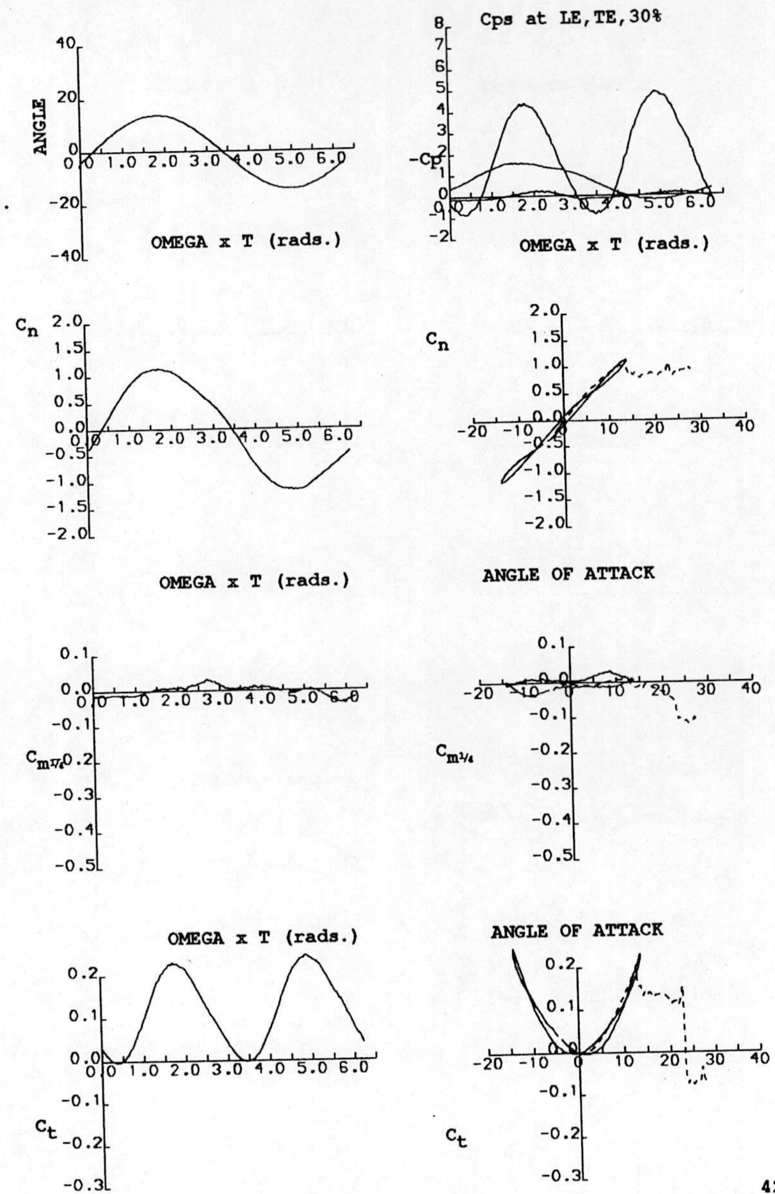
AIR TEMPERATURE = 29.2°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54321

REYNOLDS NUMBER = 1953014.

DYNAMIC PRESSURE = 1759.84 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

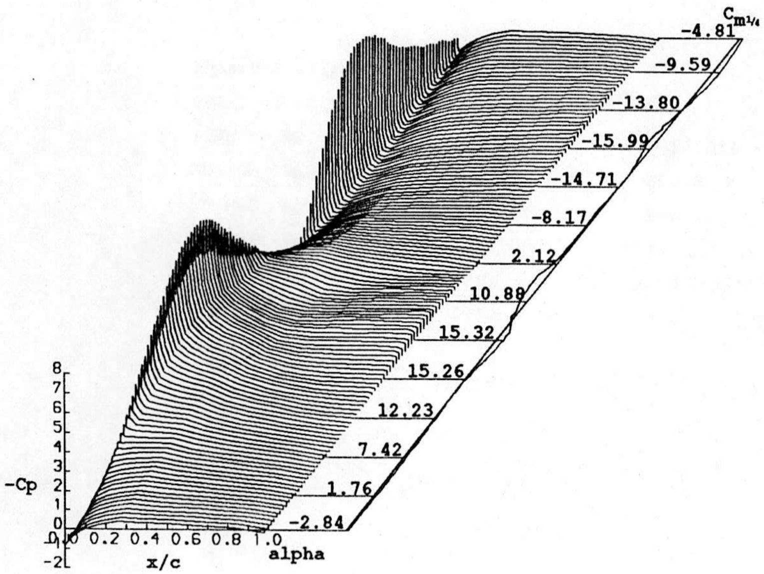
MACH NUMBER = 0.157

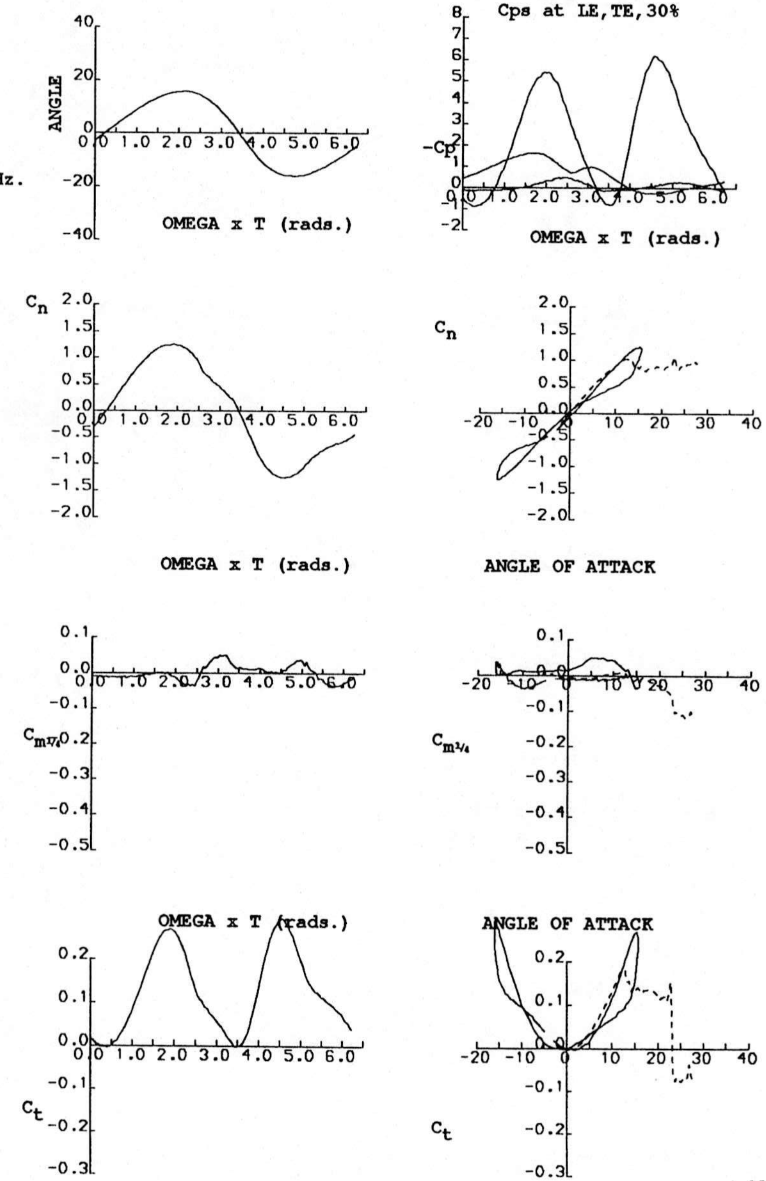
AIR TEMPERATURE = 26.9°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 13.80°

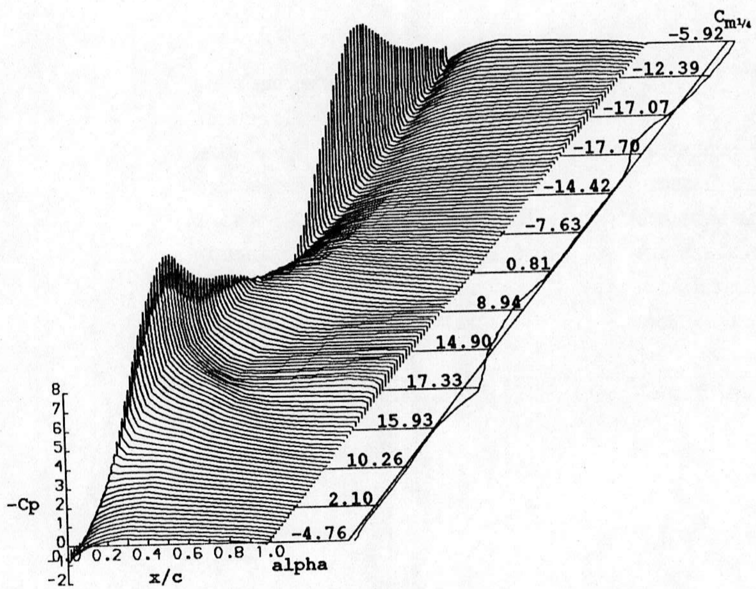


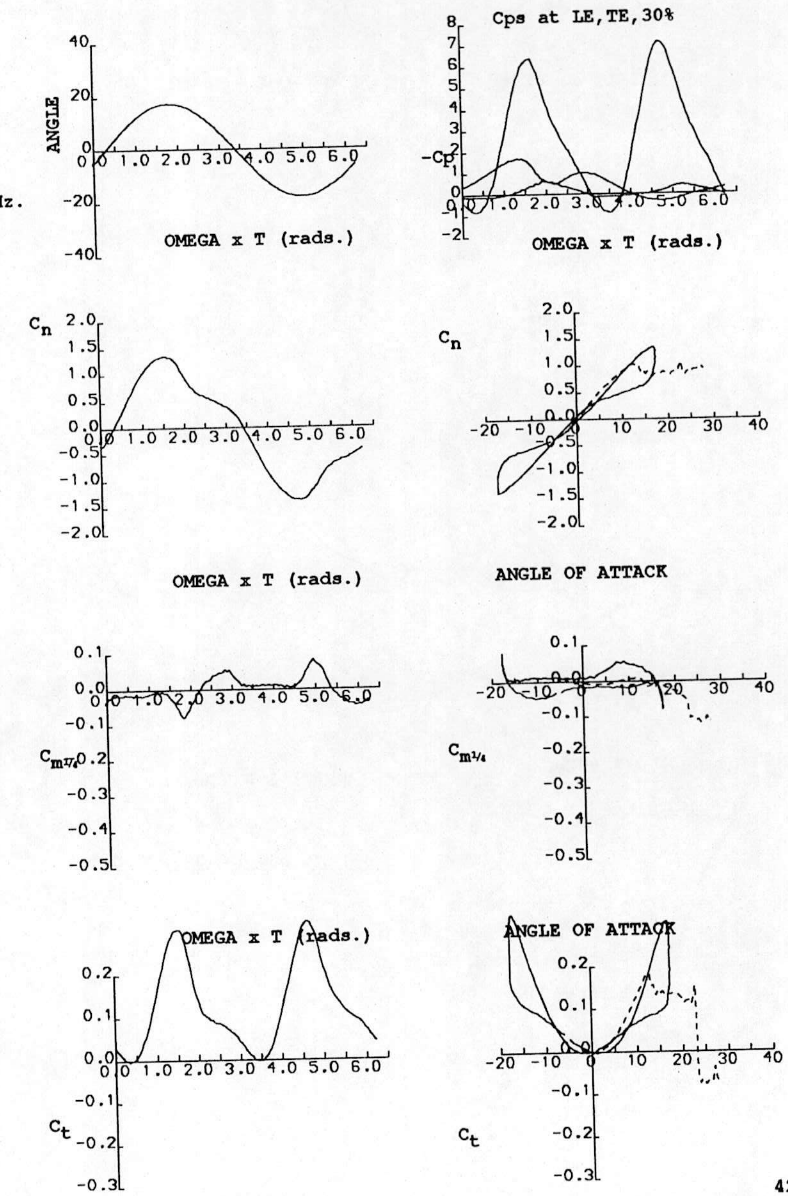


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14261
REYNOLDS NUMBER = 1894203.
DYNAMIC PRESSURE = 1692.41 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.630 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.154
AIR TEMPERATURE = 29.5°C
SAMPLING FREQUENCY = 208.64 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54331

REYNOLDS NUMBER = 1948026.

DYNAMIC PRESSURE = 1759.84 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

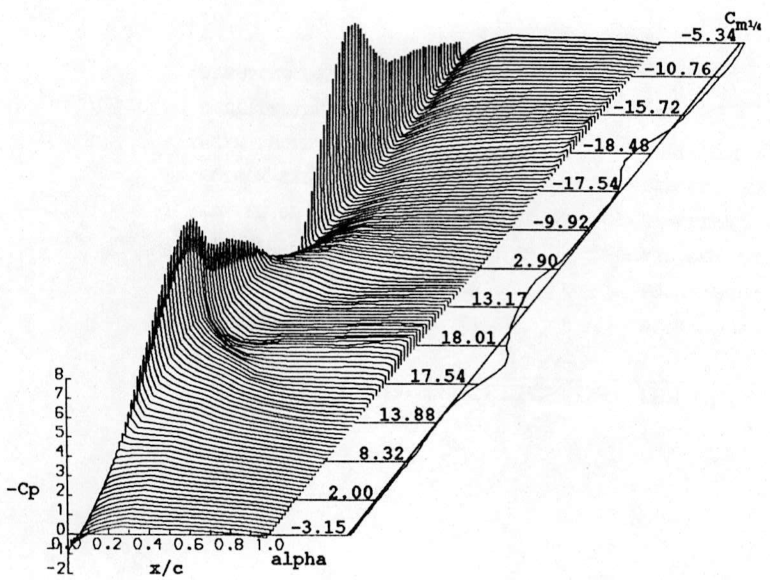
MACH NUMBER = 0.157

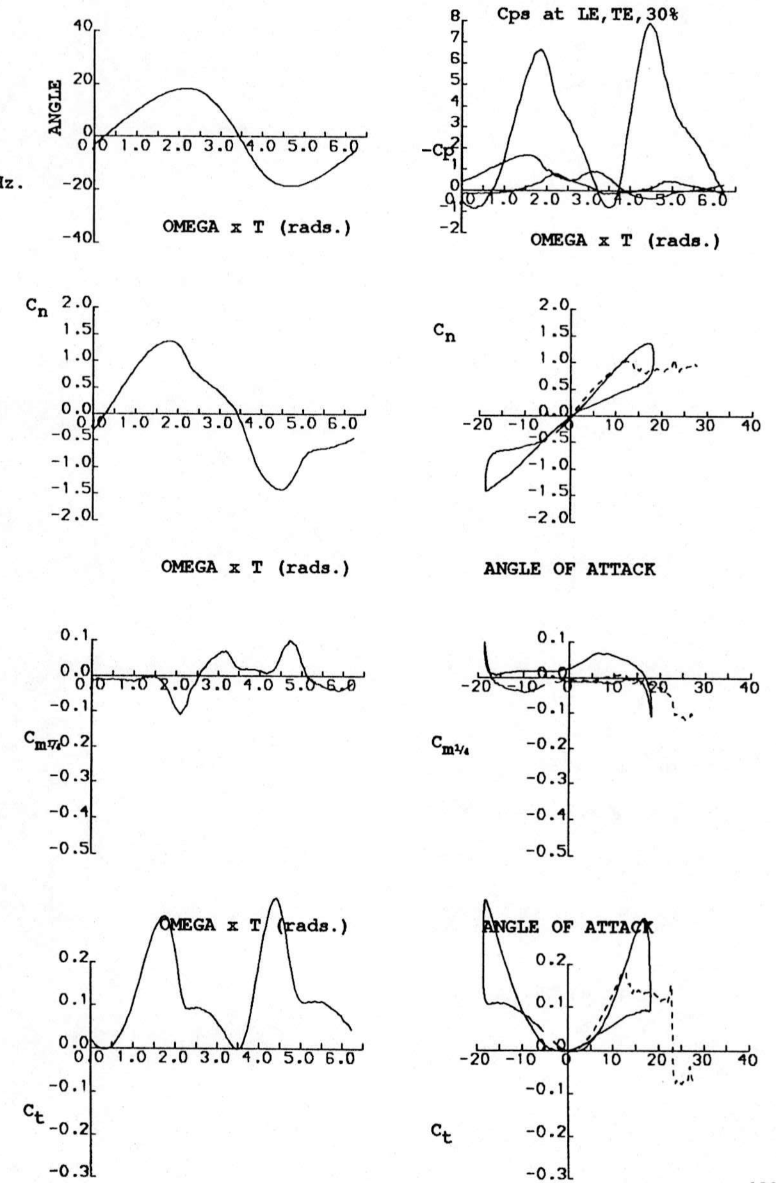
AIR TEMPERATURE = 27.5°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14271

REYNOLDS NUMBER = 1891805.

DYNAMIC PRESSURE = 1692.41 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

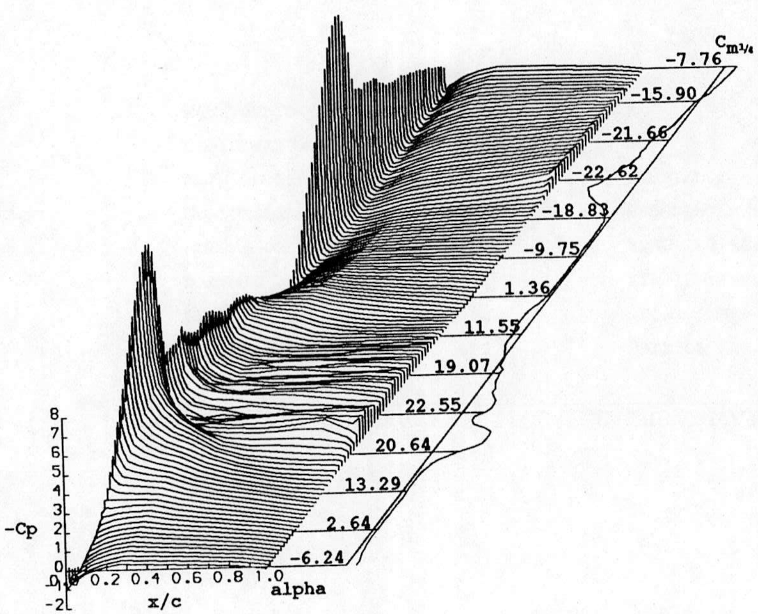
MACH NUMBER = 0.154

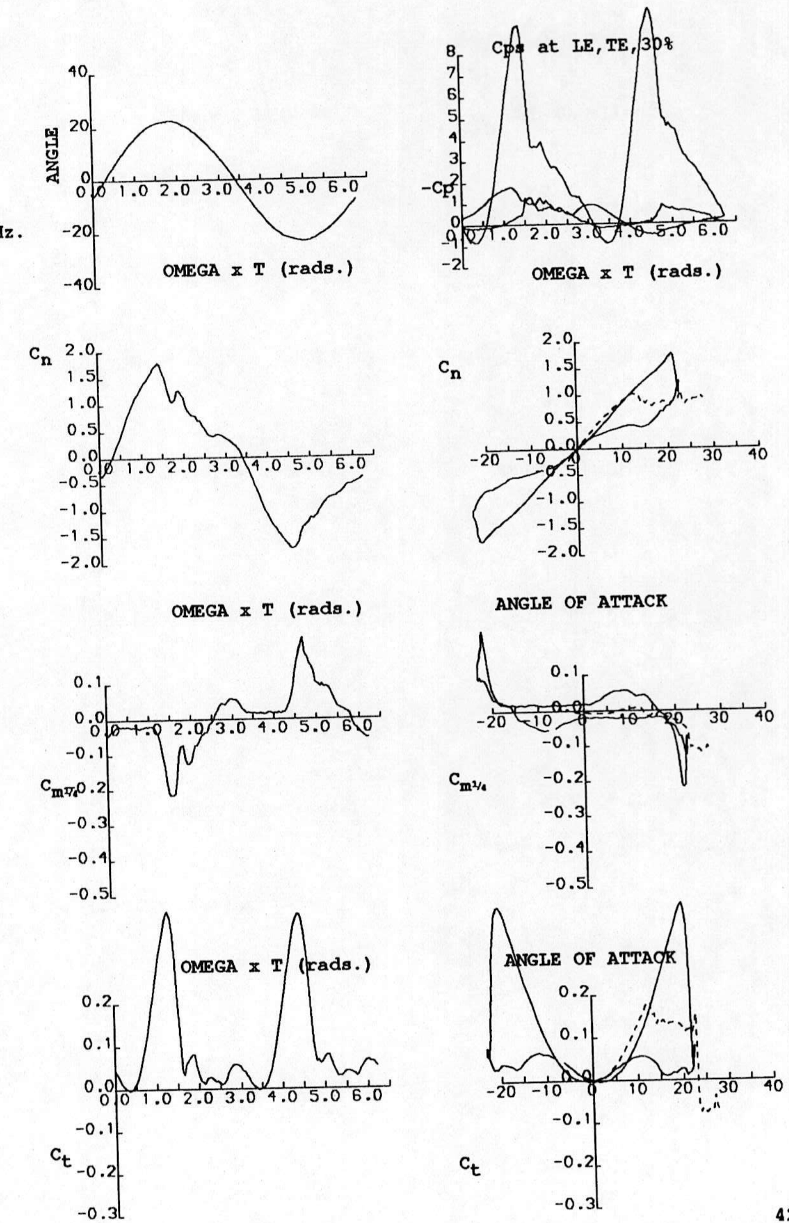
AIR TEMPERATURE = 29.8°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54341

REYNOLDS NUMBER = 1944713.

DYNAMIC PRESSURE = 1759.84 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

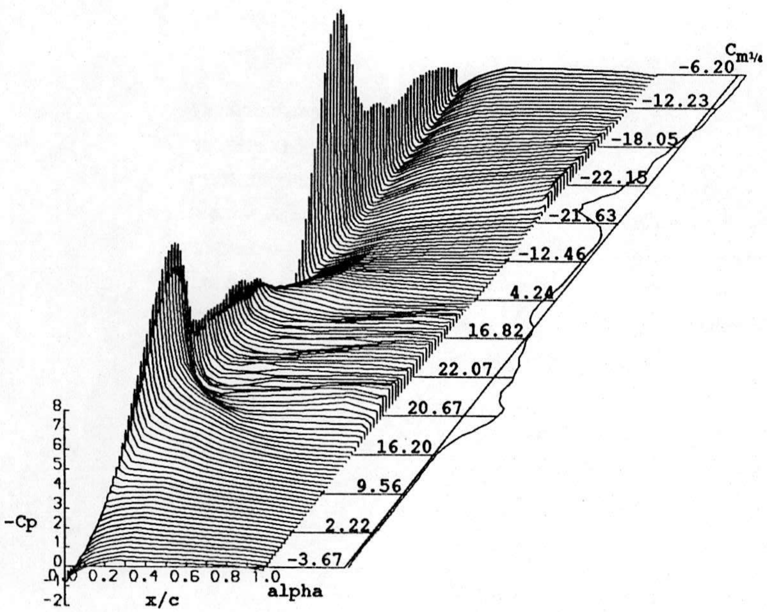
MACH NUMBER = 0.157

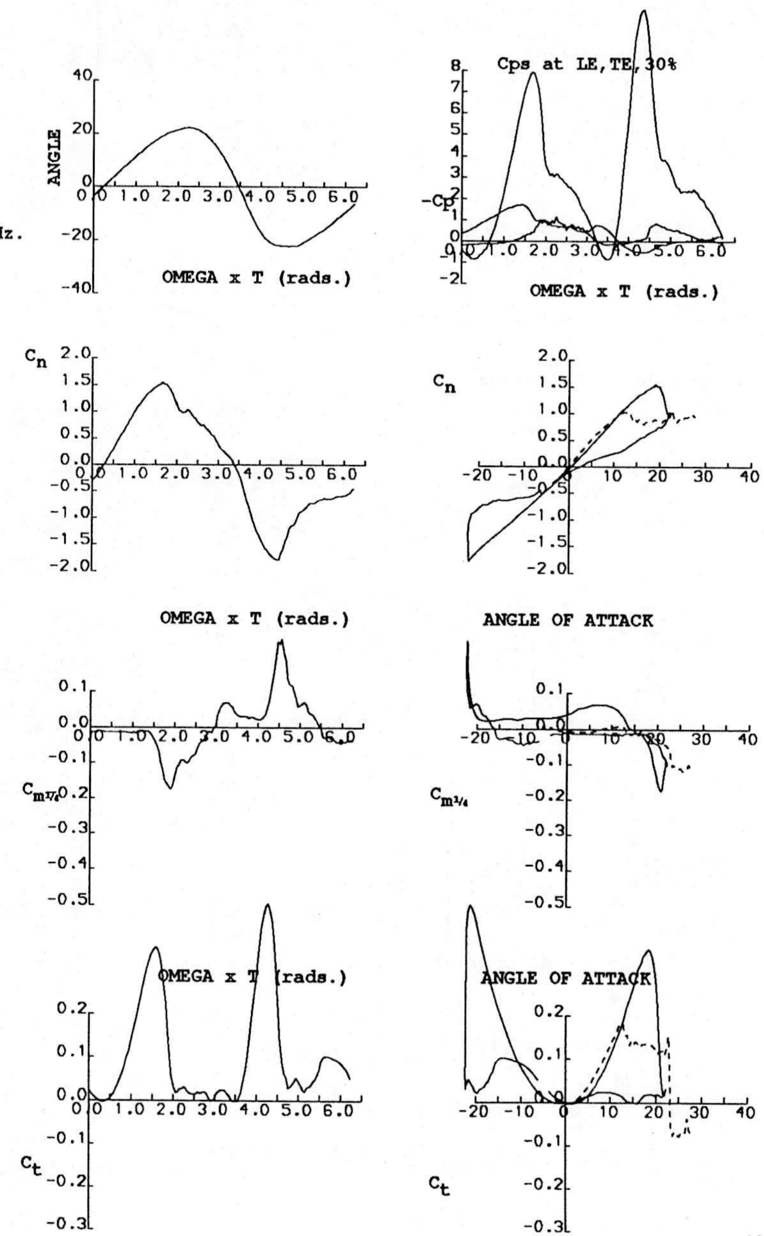
AIR TEMPERATURE = 27.9°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.051

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14281

REYNOLDS NUMBER = 1888616.

DYNAMIC PRESSURE = 1692.41 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.630 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

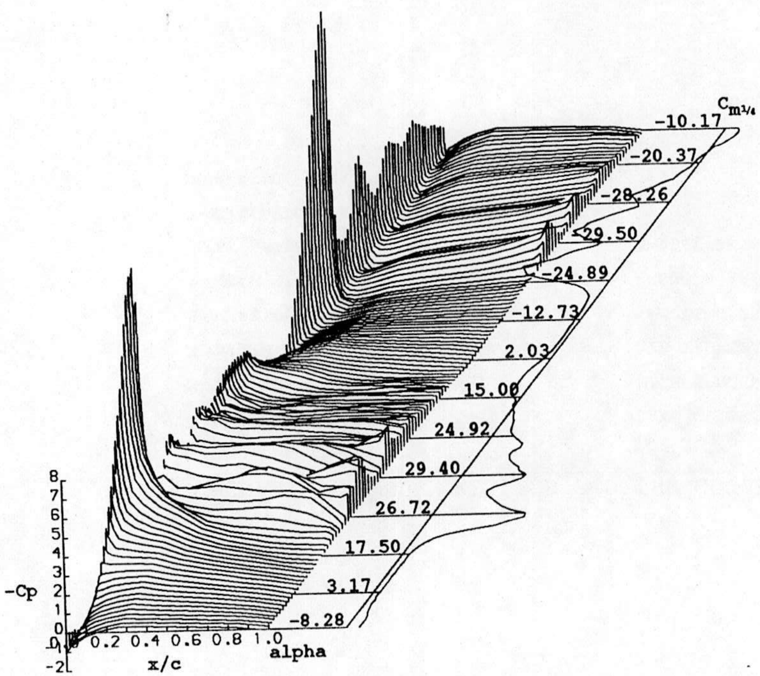
MACH NUMBER = 0.154

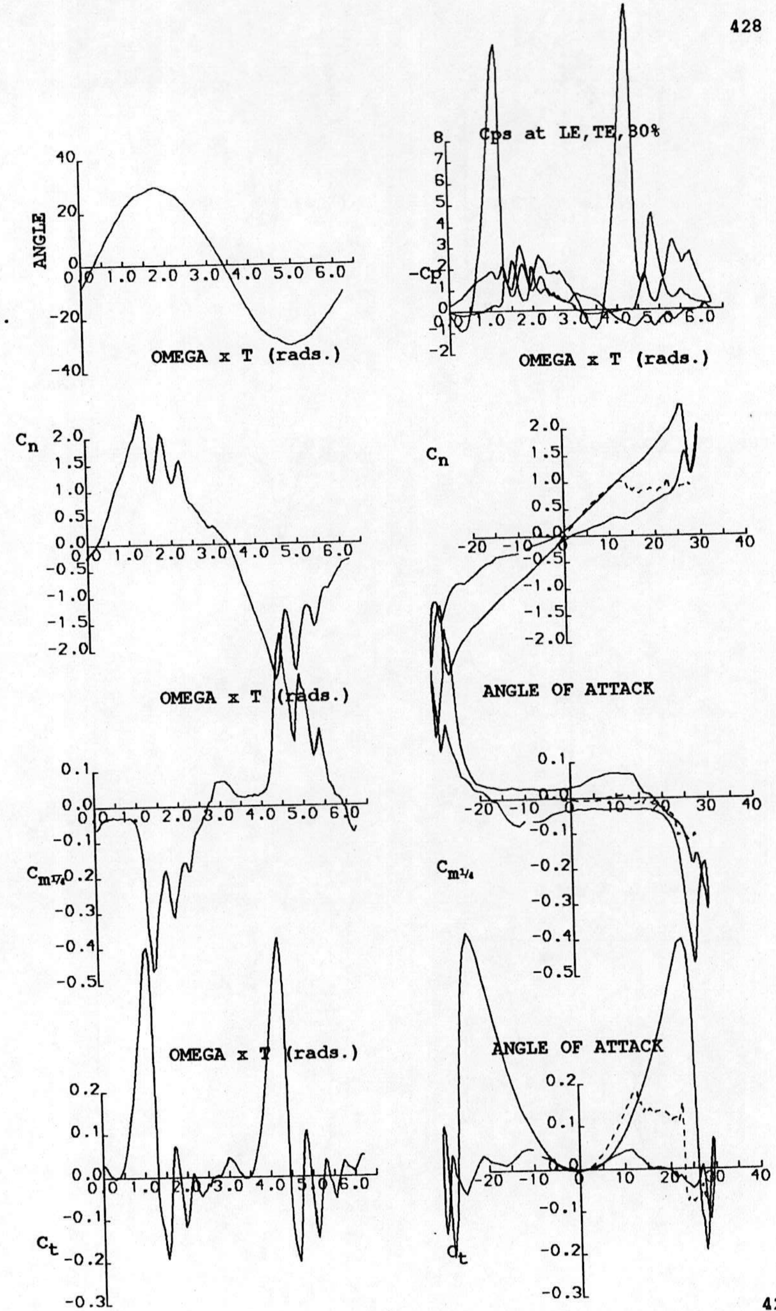
AIR TEMPERATURE = 30.2°C

SAMPLING FREQUENCY = 208.64 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 30.00°

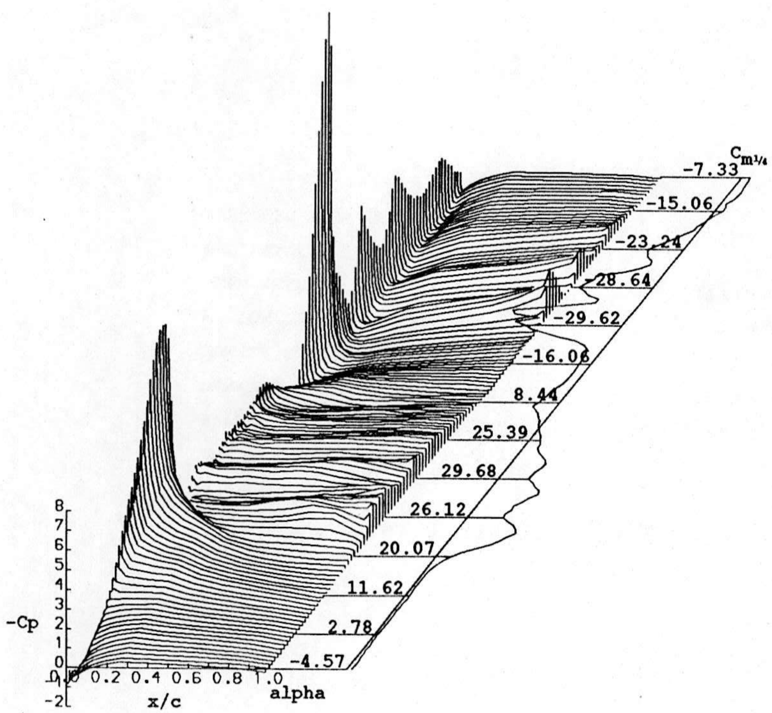


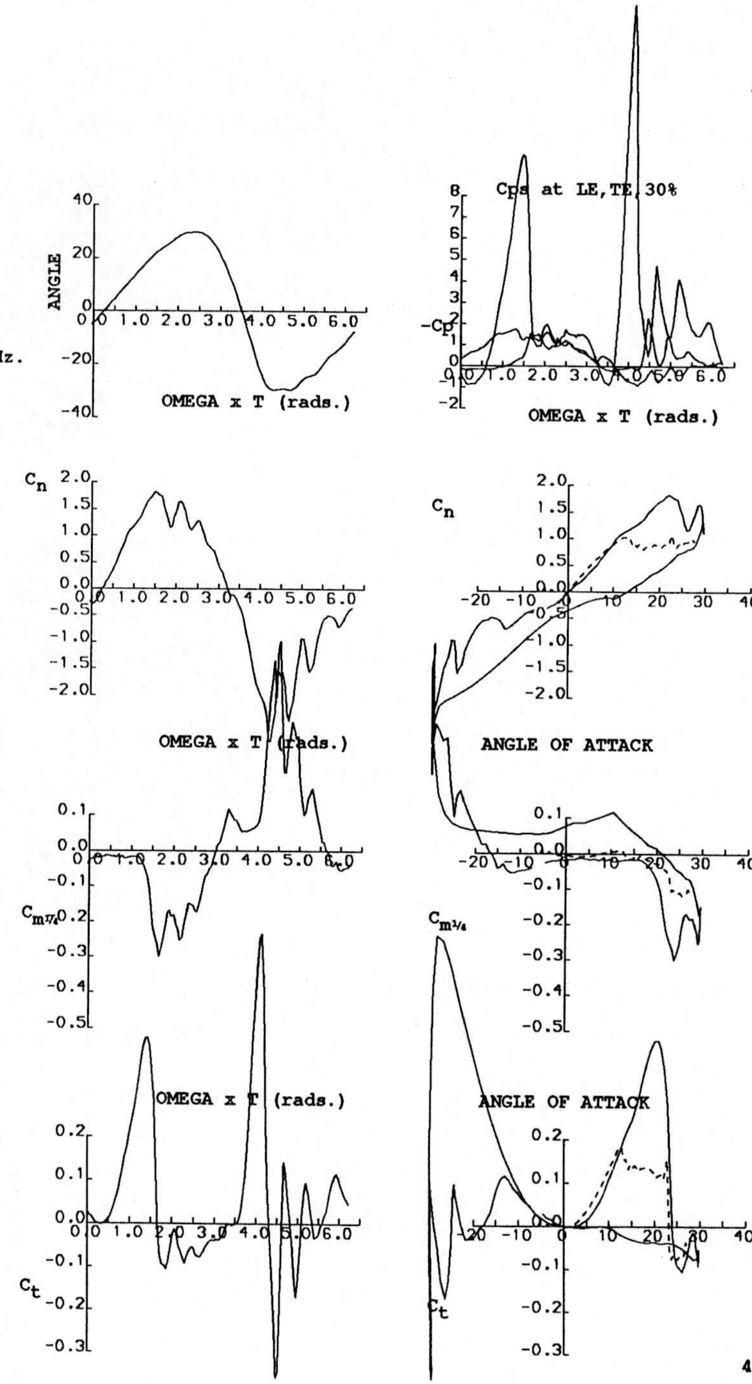


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54351
REYNOLDS NUMBER = 1940588.
DYNAMIC PRESSURE = 1759.84 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.630 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.157
AIR TEMPERATURE = 28.4°C
SAMPLING FREQUENCY = 208.64 Hz.
REDUCED FREQUENCY = 0.051
AMPLITUDE = 30.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14441

REYNOLDS NUMBER = 1084633.

DYNAMIC PRESSURE = 521.81 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

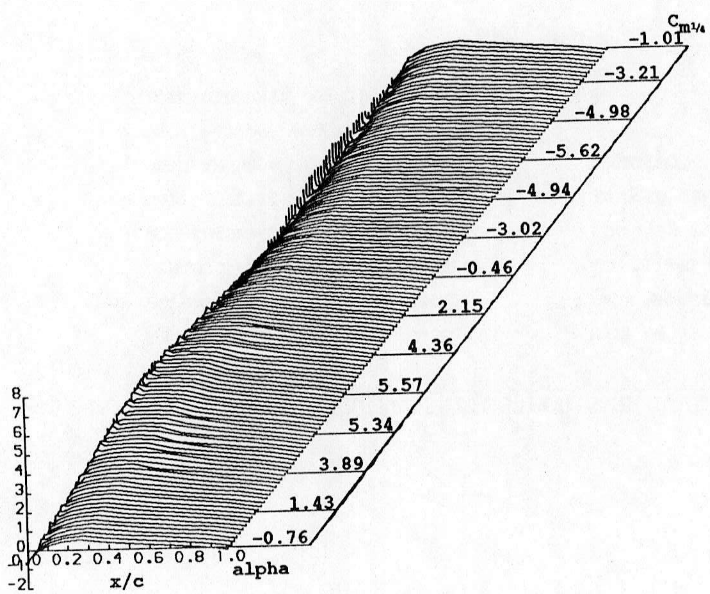
MACH NUMBER = 0.086

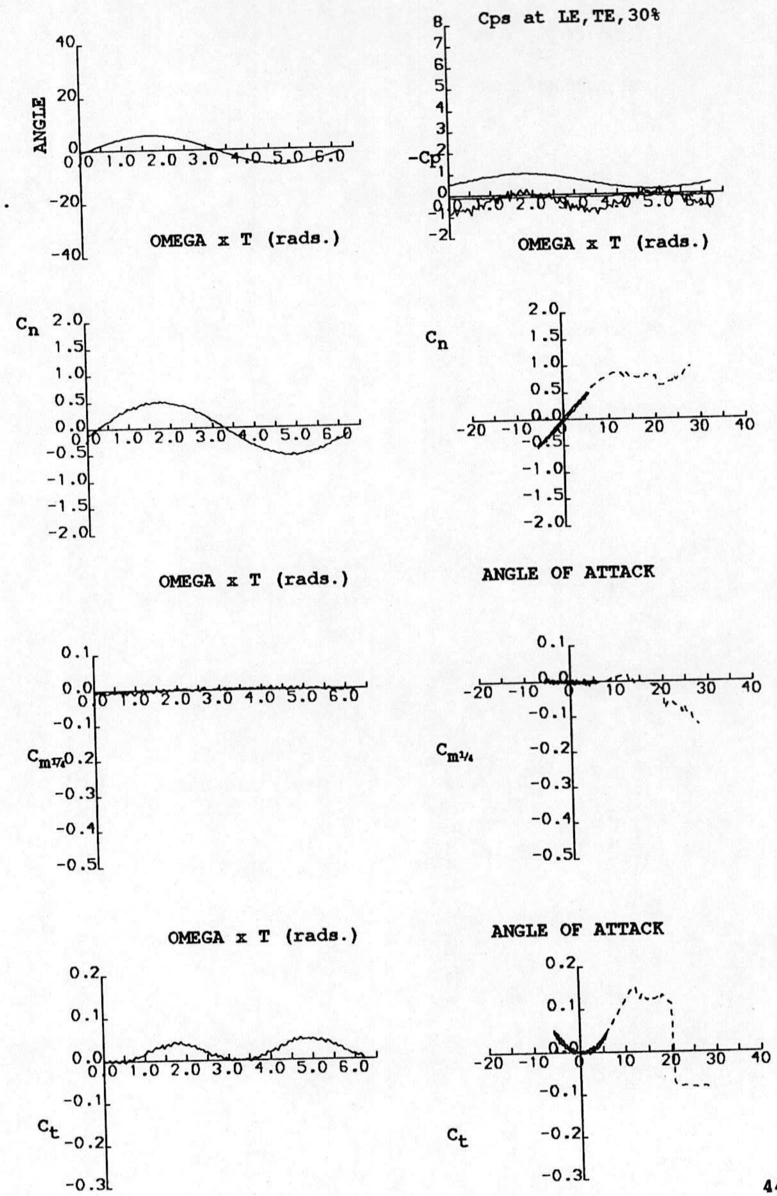
AIR TEMPERATURE = 22.4°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

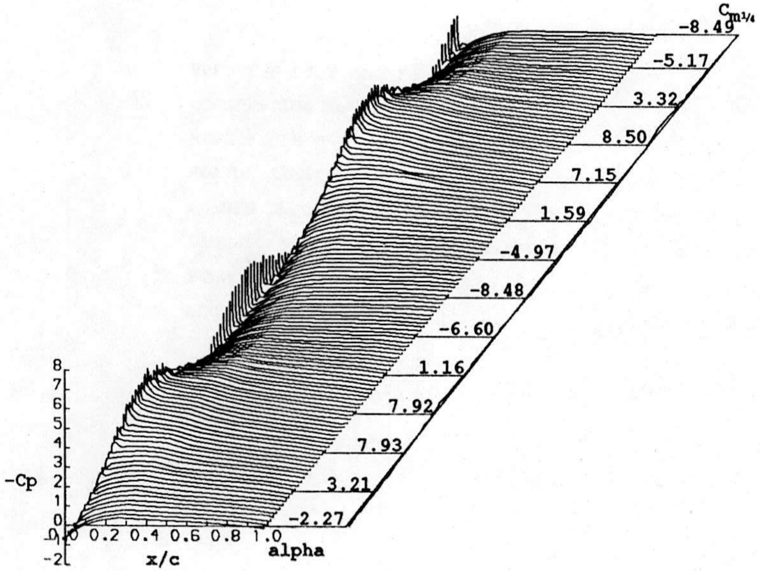
AMPLITUDE = 5.40°

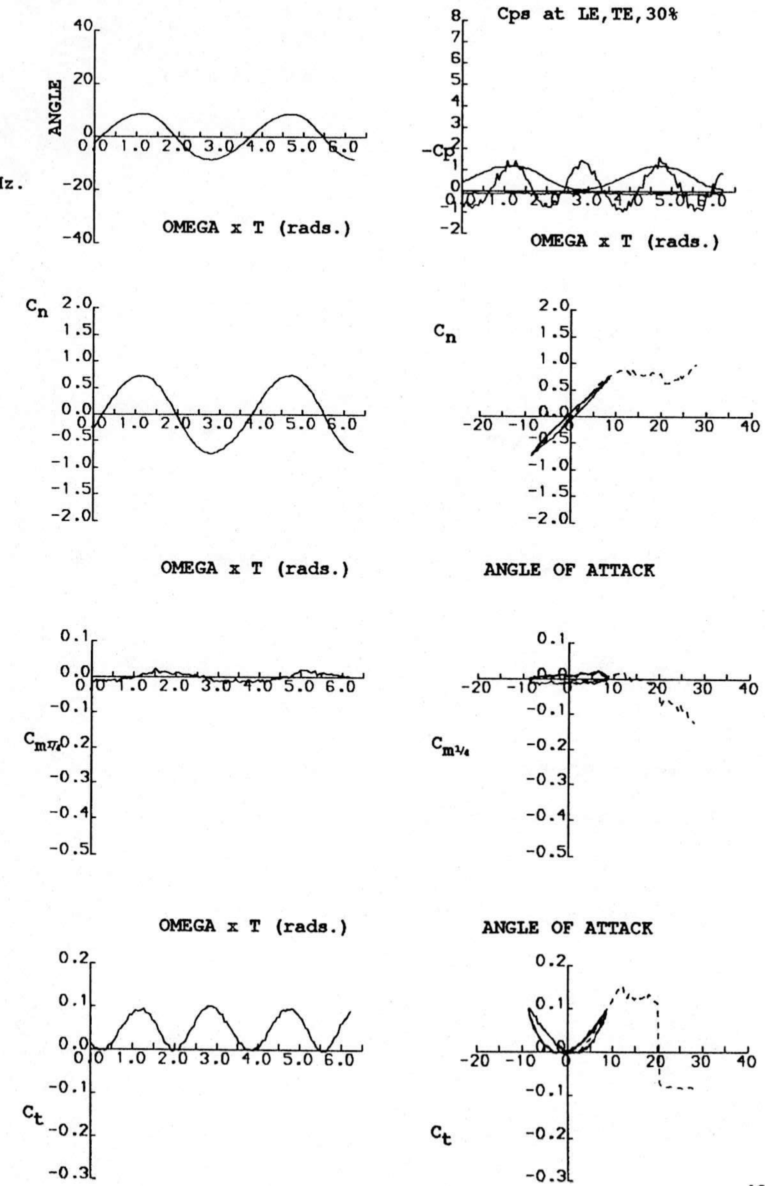




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54371	DATE OF TEST: 4/3/92
REYNOLDS NUMBER = 1084946.	MACH NUMBER = 0.086
DYNAMIC PRESSURE = 522.11 Nm^{-2}	AIR TEMPERATURE = 22.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 114.43 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.052
MEAN ANGLE = 0.00°	AMPLITUDE = 5.40°
OSCILLATION FREQUENCY = 0.894 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14451

REYNOLDS NUMBER = 1084162.

DYNAMIC PRESSURE = 521.81 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

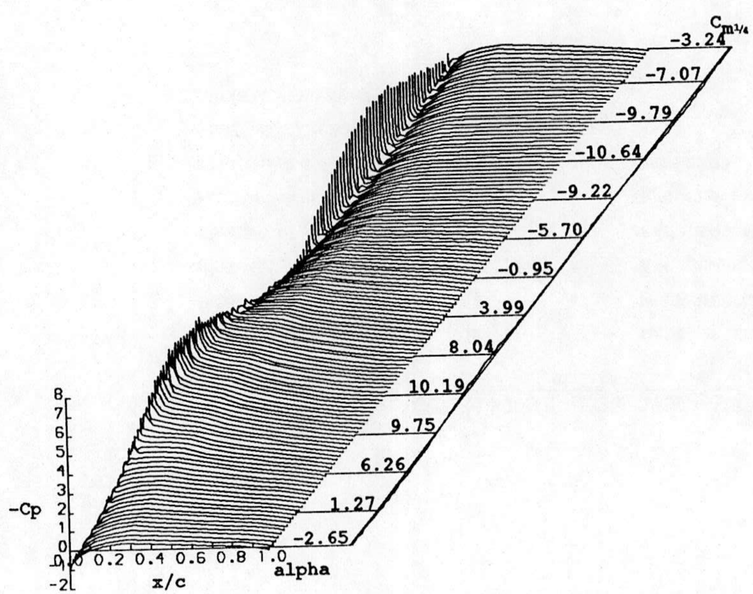
MACH NUMBER = 0.086

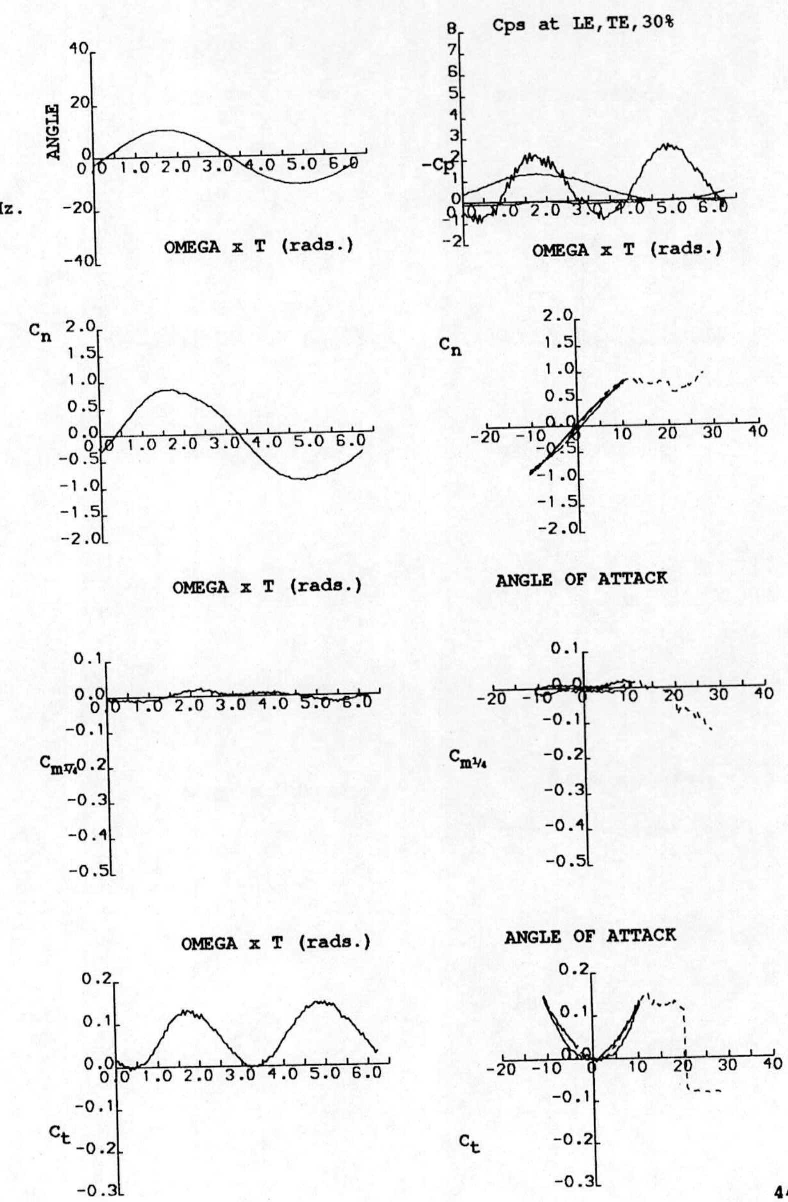
AIR TEMPERATURE = 22.5°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54381

REYNOLDS NUMBER = 1084475.

DYNAMIC PRESSURE = 522.11 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

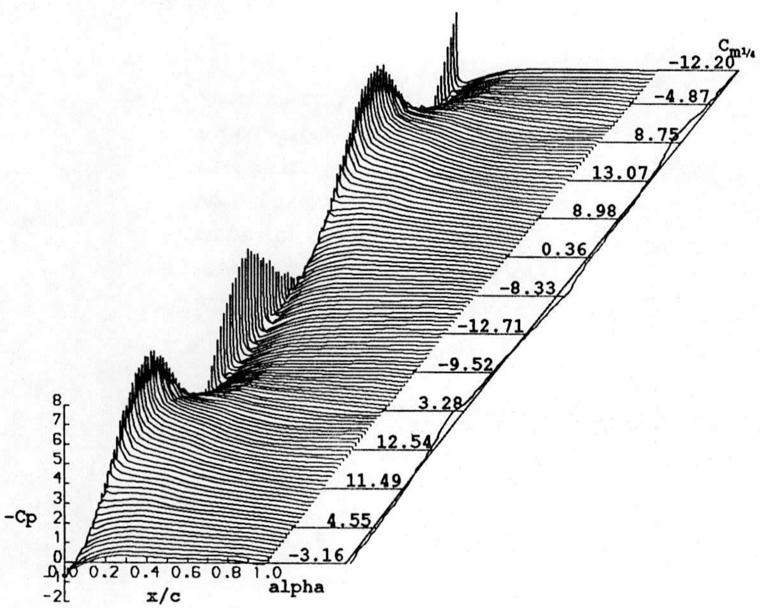
MACH NUMBER = 0.086

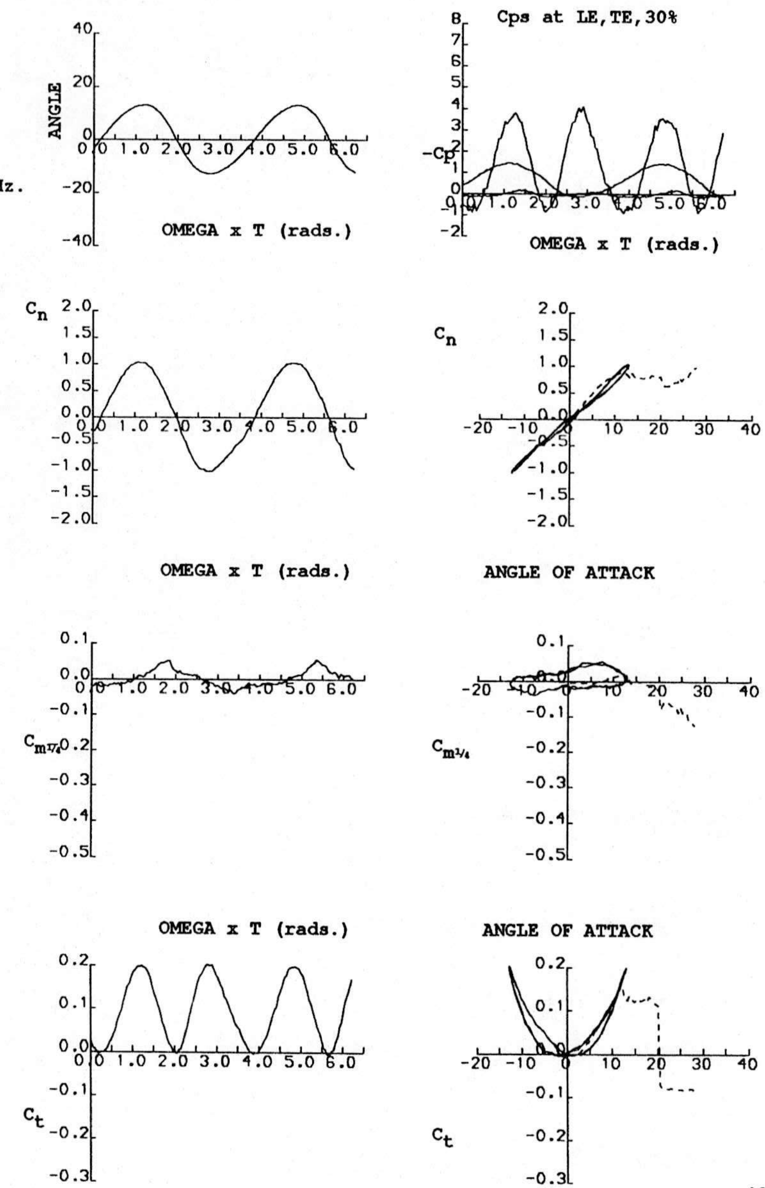
AIR TEMPERATURE = 22.5°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14461

REYNOLDS NUMBER = 1083691.

DYNAMIC PRESSURE = 521.81 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

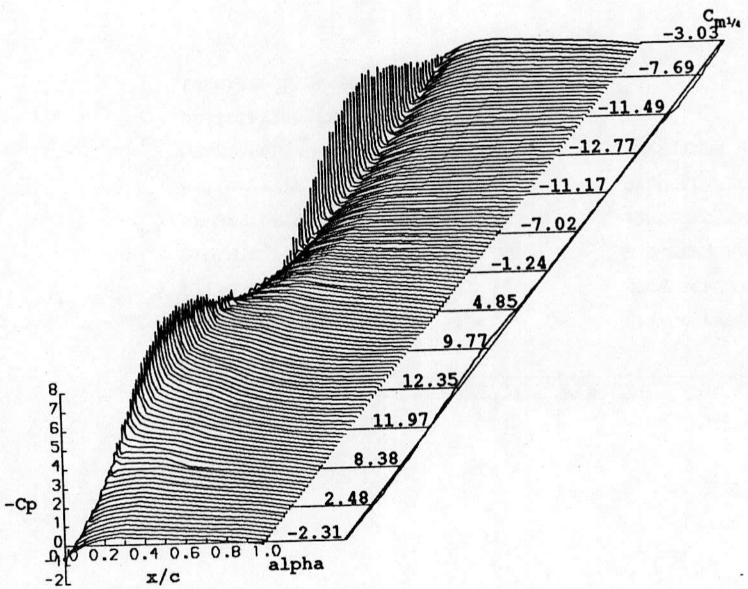
MACH NUMBER = 0.086

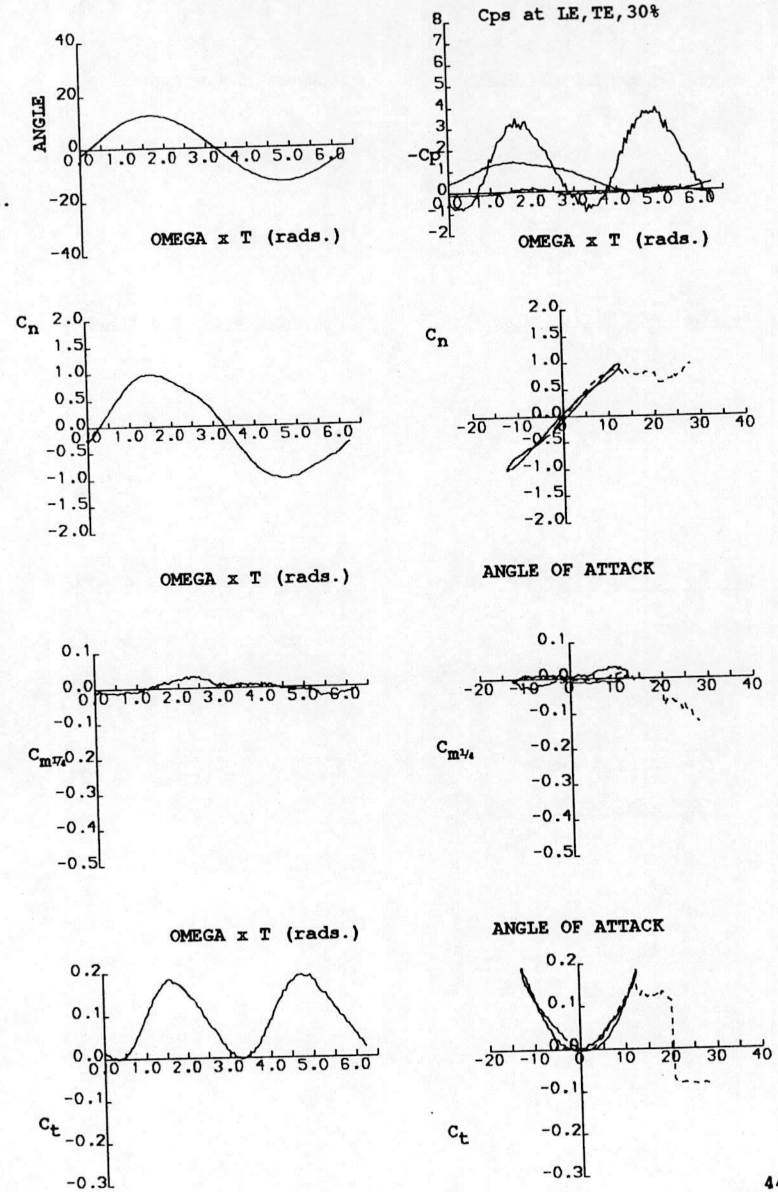
AIR TEMPERATURE = 22.6°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54391

REYNOLDS NUMBER = 1084004.

DYNAMIC PRESSURE = 522.11 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

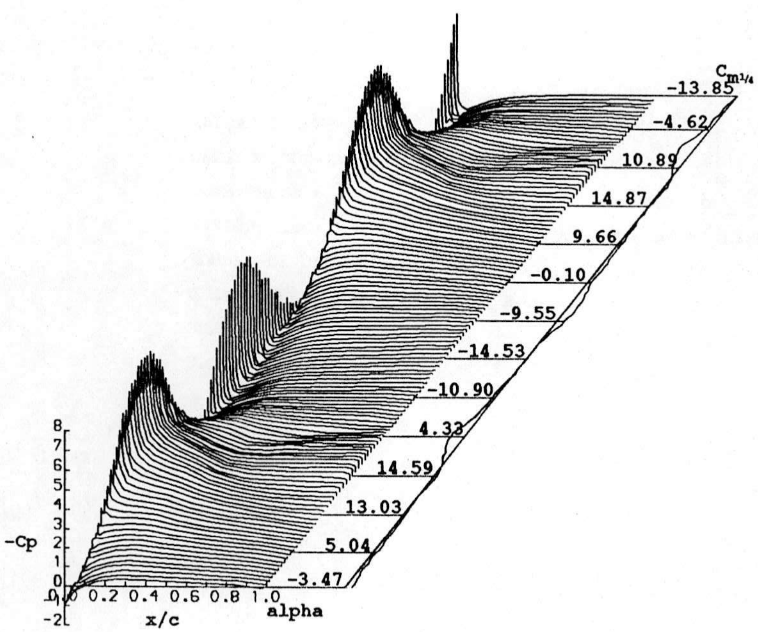
MACH NUMBER = 0.086

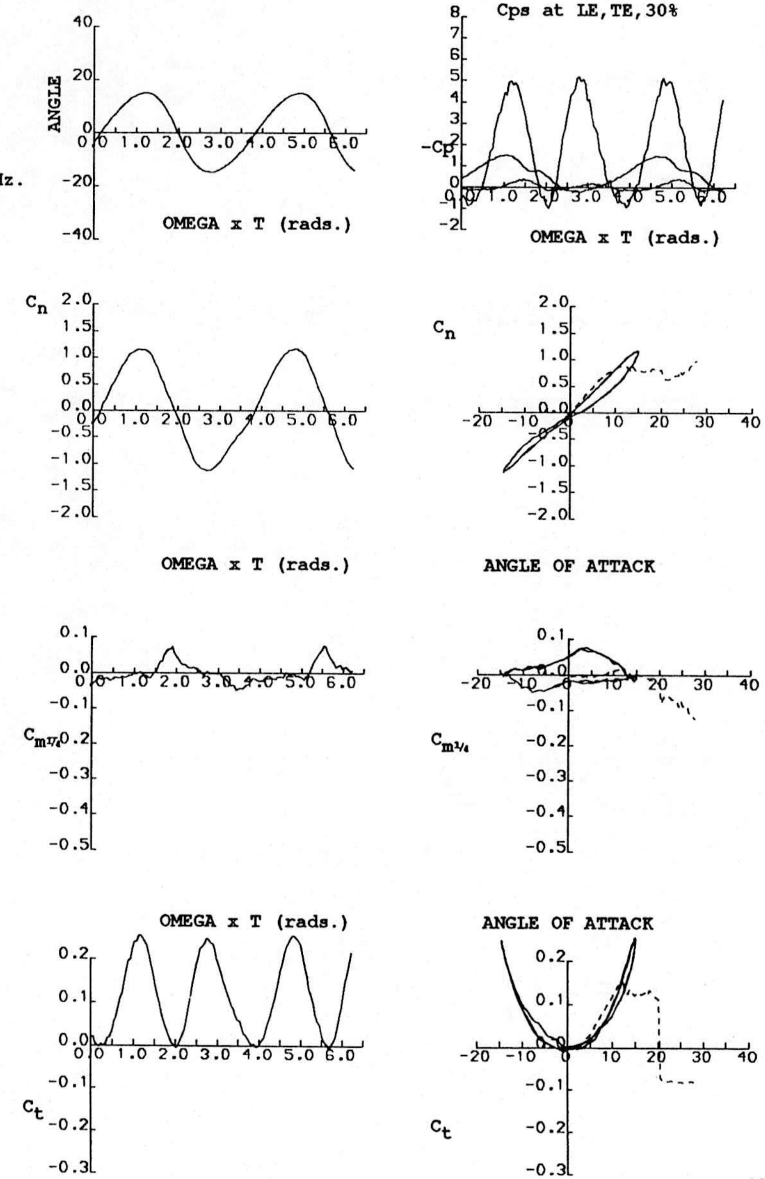
AIR TEMPERATURE = 22.6°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 12.20°

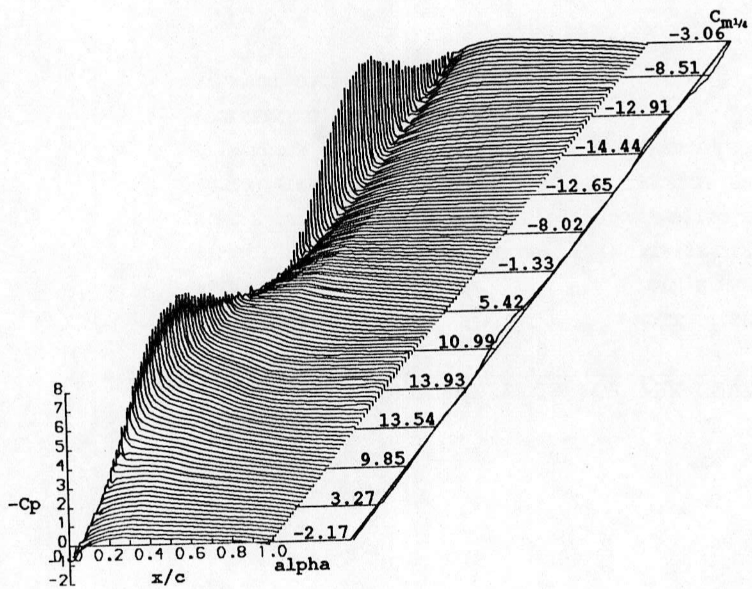


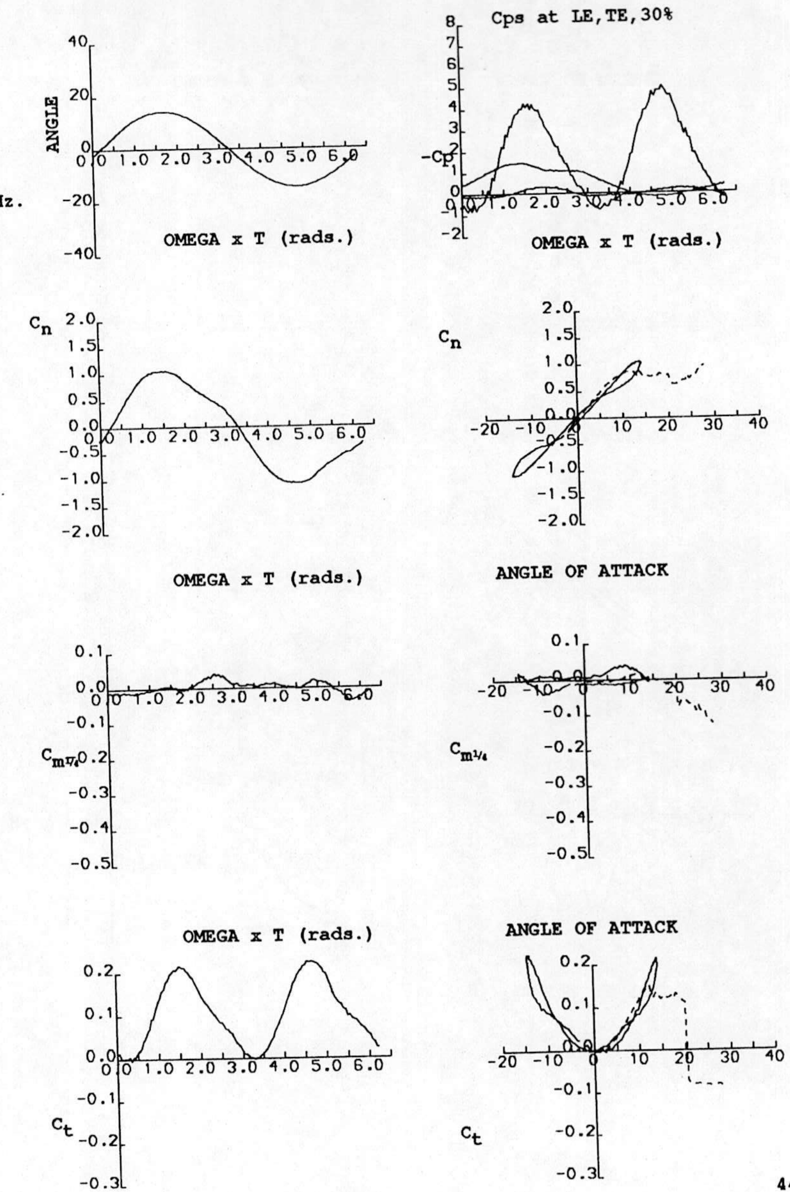


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14471
REYNOLDS NUMBER = 1083221.
DYNAMIC PRESSURE = 521.81 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 13.80°

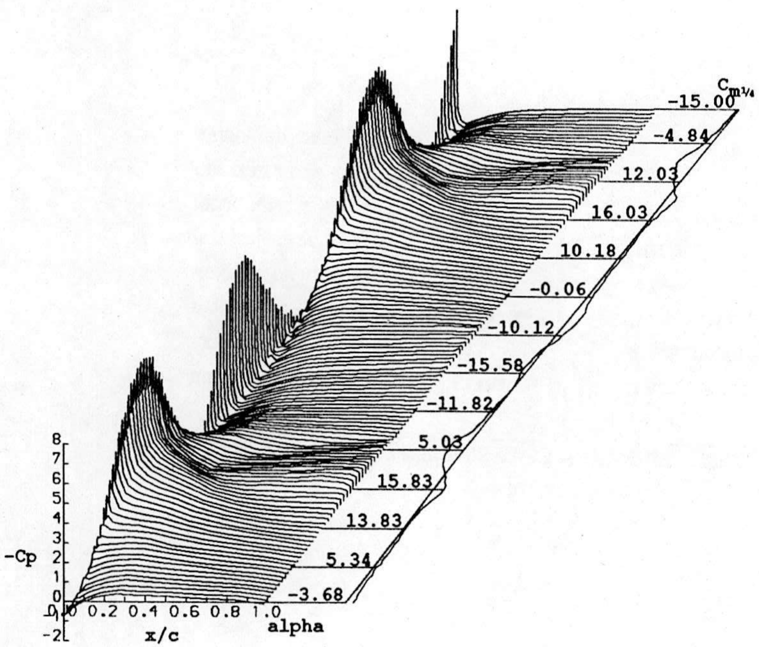


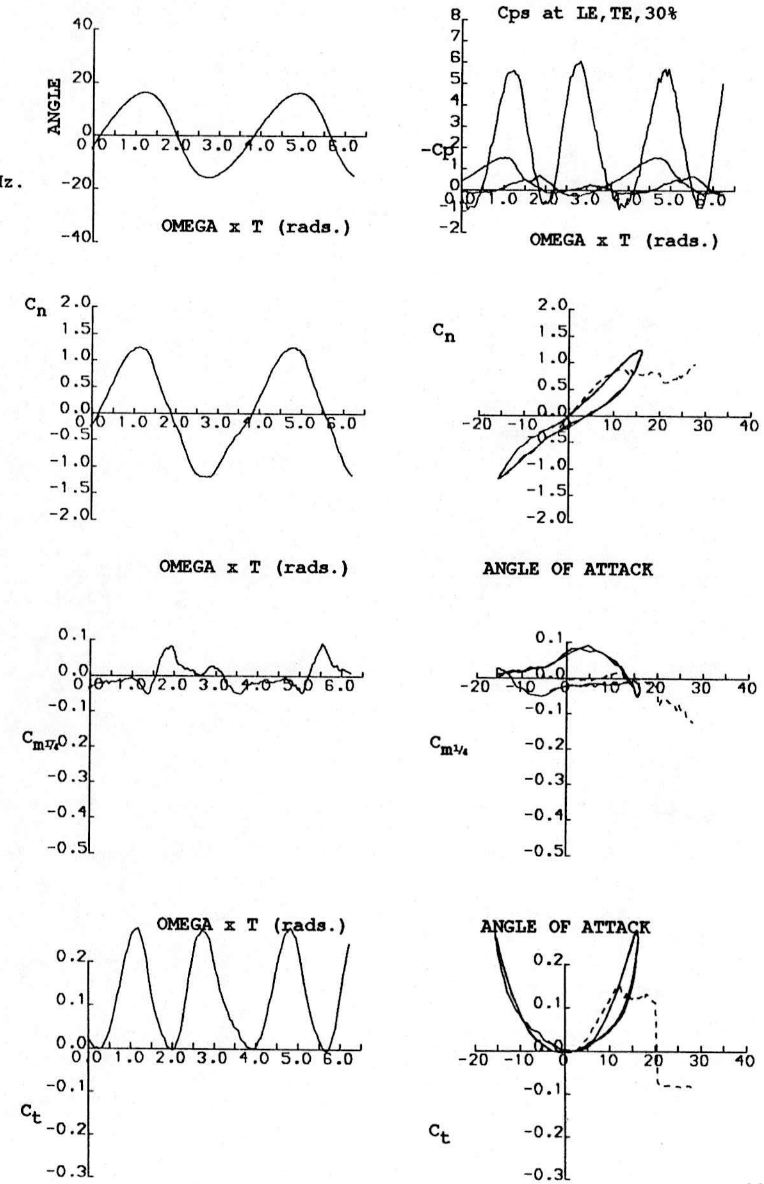


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54401
REYNOLDS NUMBER = 1084004.
DYNAMIC PRESSURE = 522.11 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.6°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 13.80°

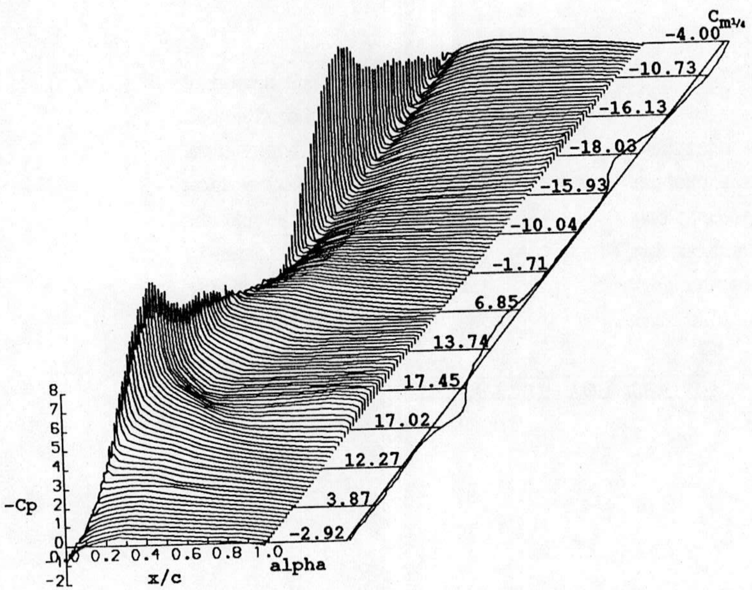


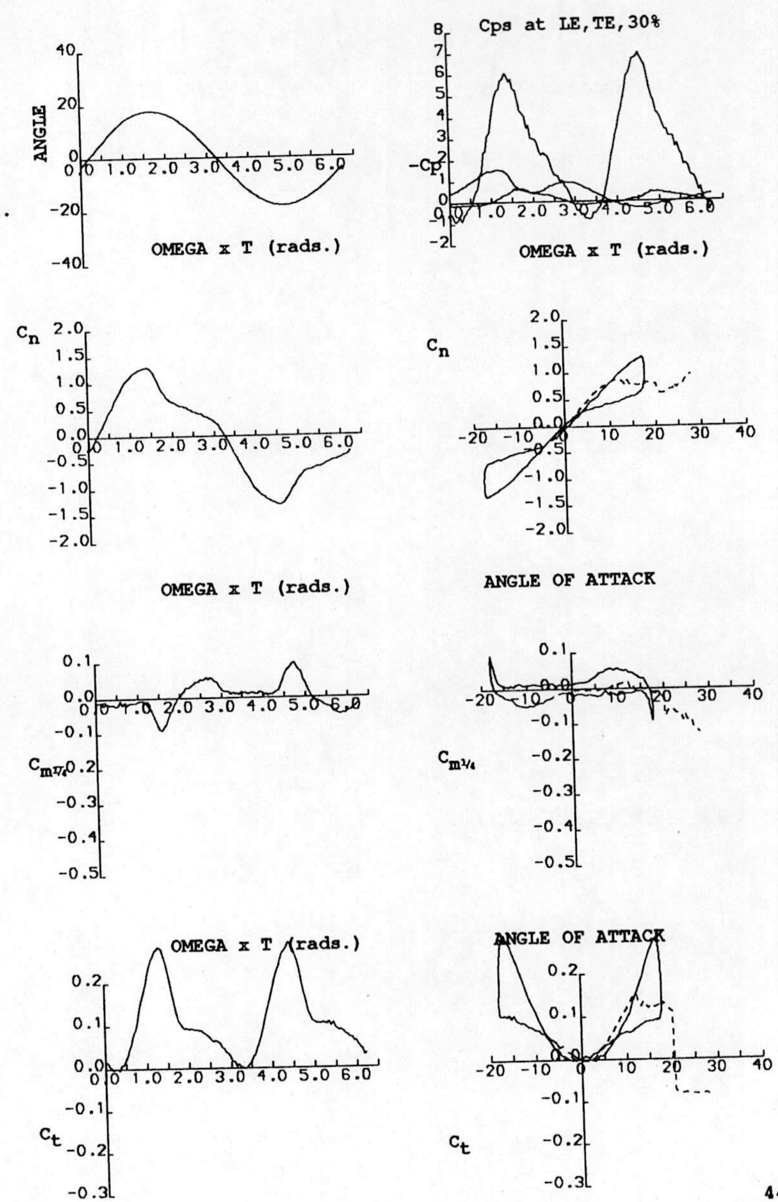


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14481
REYNOLDS NUMBER = 1083221.
DYNAMIC PRESSURE = 521.81 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 17.40°

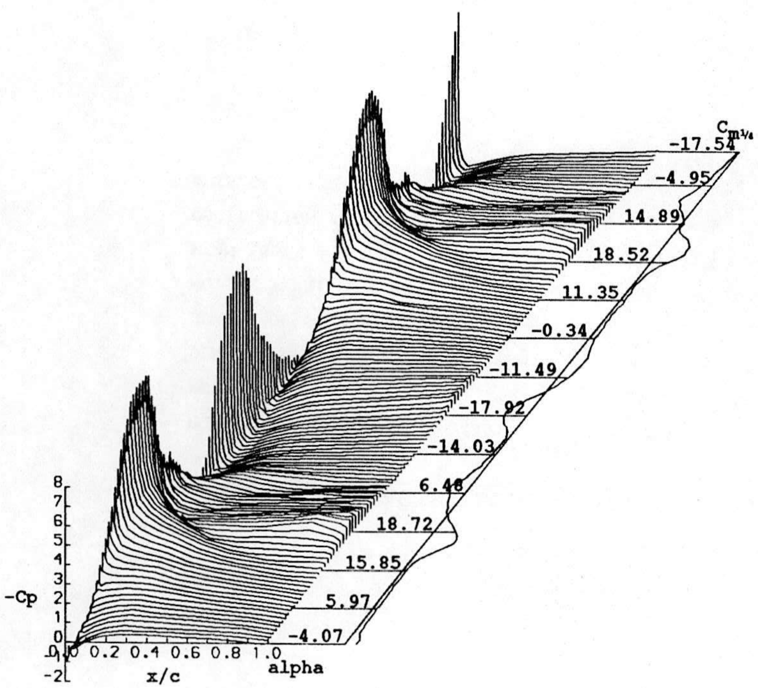


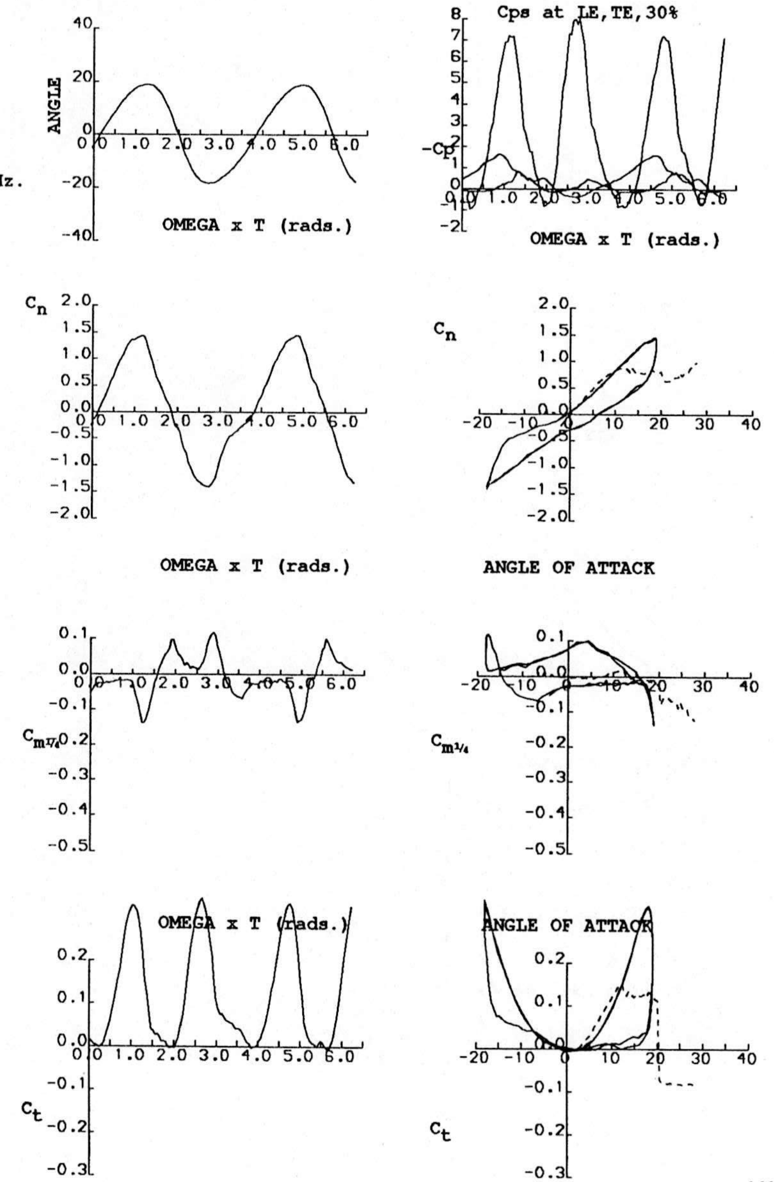


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54411
REYNOLDS NUMBER = 1083534.
DYNAMIC PRESSURE = 522.11 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14491

REYNOLDS NUMBER = 1083221.

DYNAMIC PRESSURE = 521.81 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

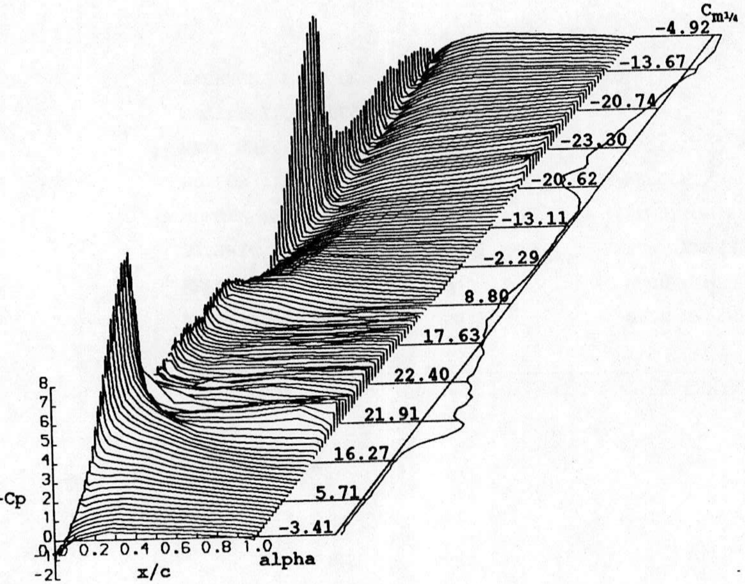
MACH NUMBER = 0.086

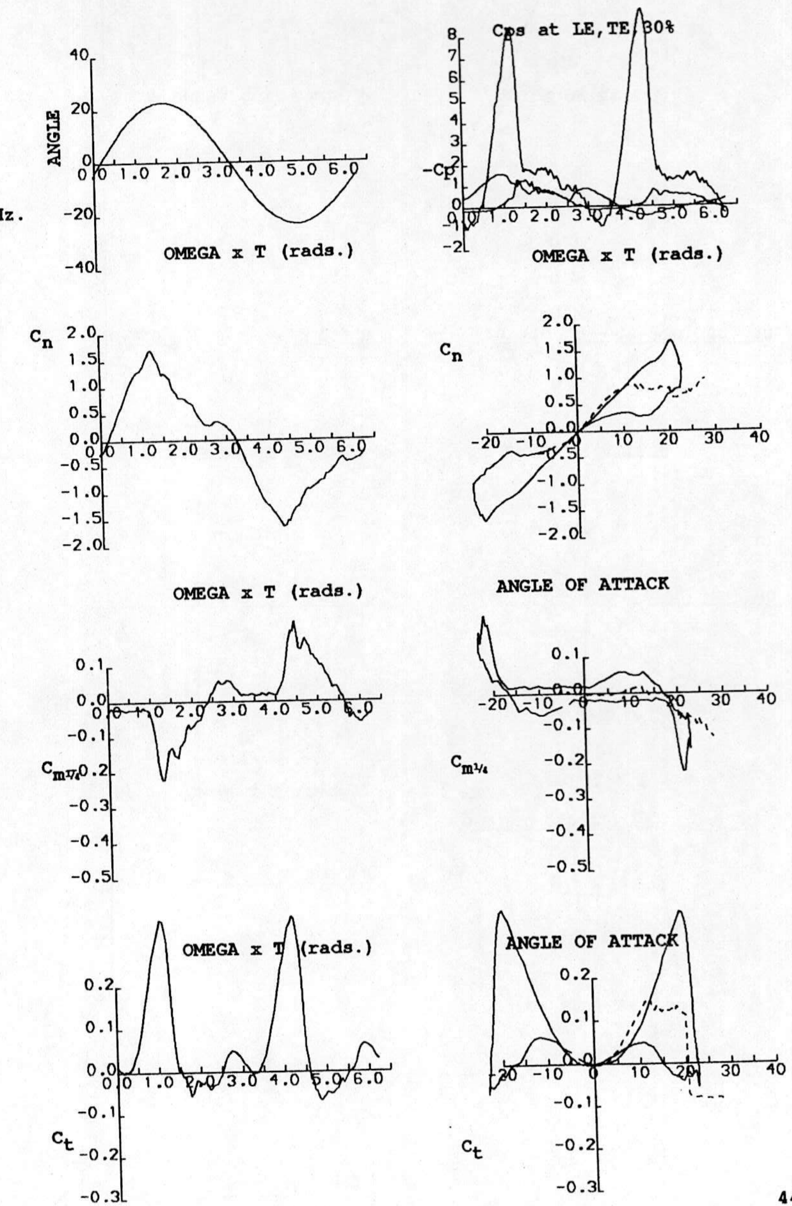
AIR TEMPERATURE = 22.7°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 22.60°

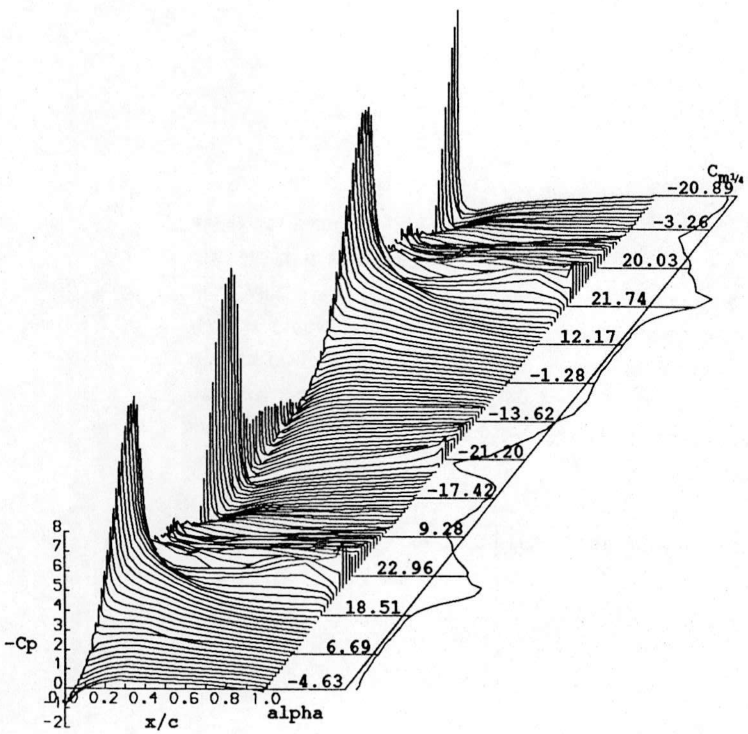


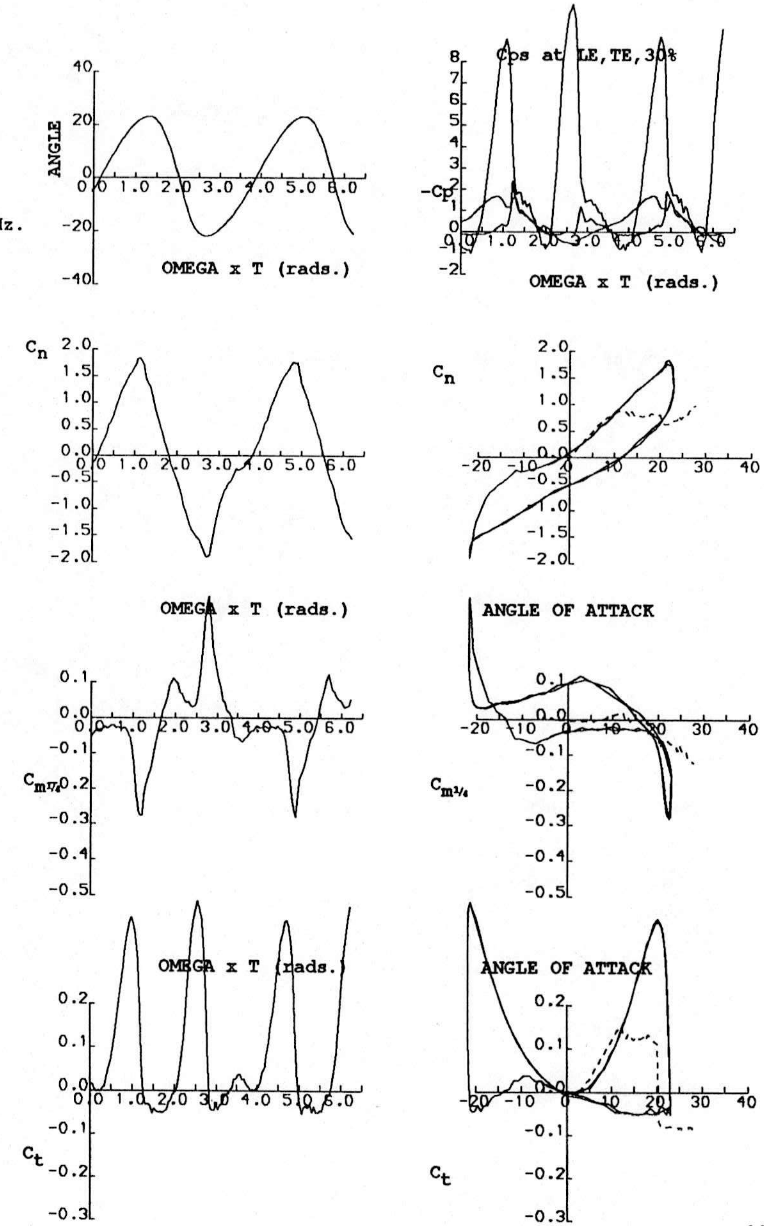


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54421
REYNOLDS NUMBER = 1083534.
DYNAMIC PRESSURE = 522.11 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 22.60°

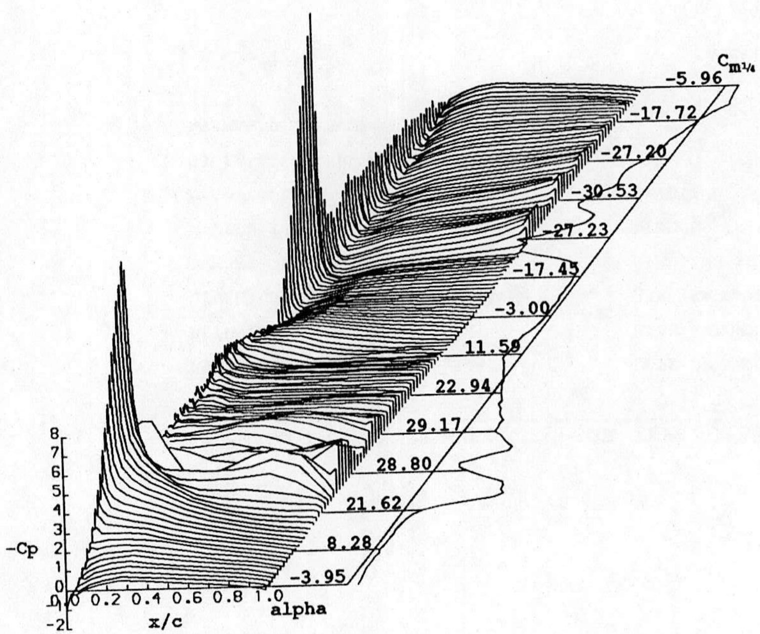


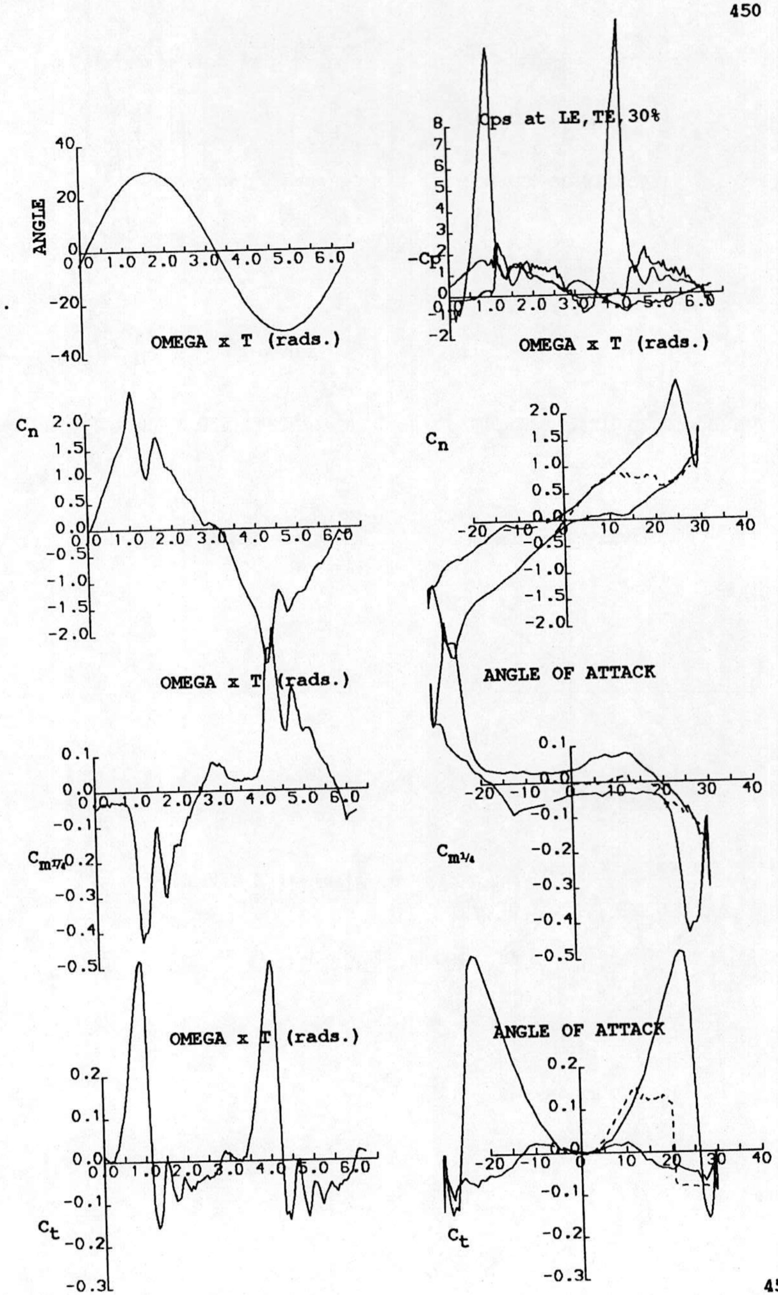


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14501
REYNOLDS NUMBER = 1082751.
DYNAMIC PRESSURE = 521.81 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.086
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 30.00°





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DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54431

REYNOLDS NUMBER = 1085854.

DYNAMIC PRESSURE = 524.81 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.849 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

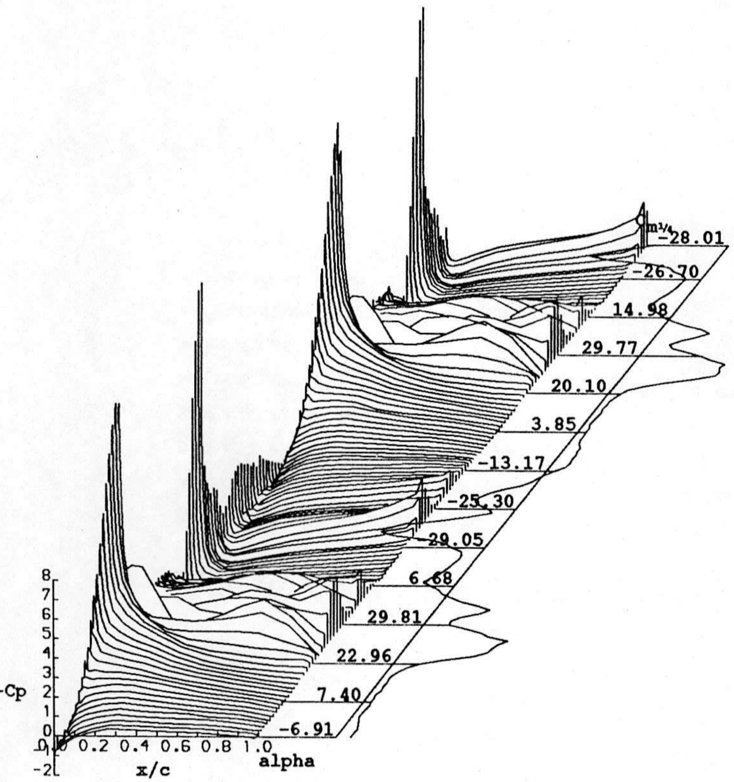
MACH NUMBER = 0.086

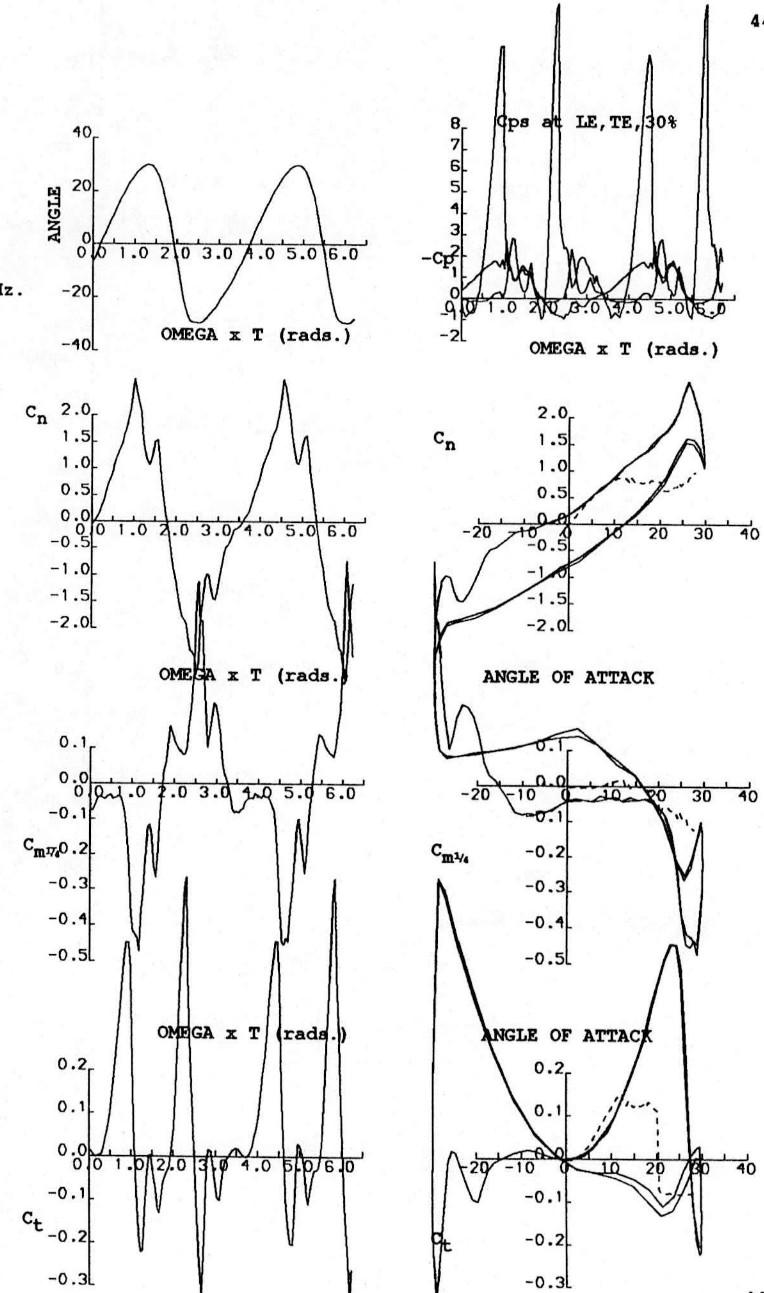
AIR TEMPERATURE = 22.8°C

SAMPLING FREQUENCY = 108.67 Hz.

REDUCED FREQUENCY = 0.050

AMPLITUDE = 30.00°

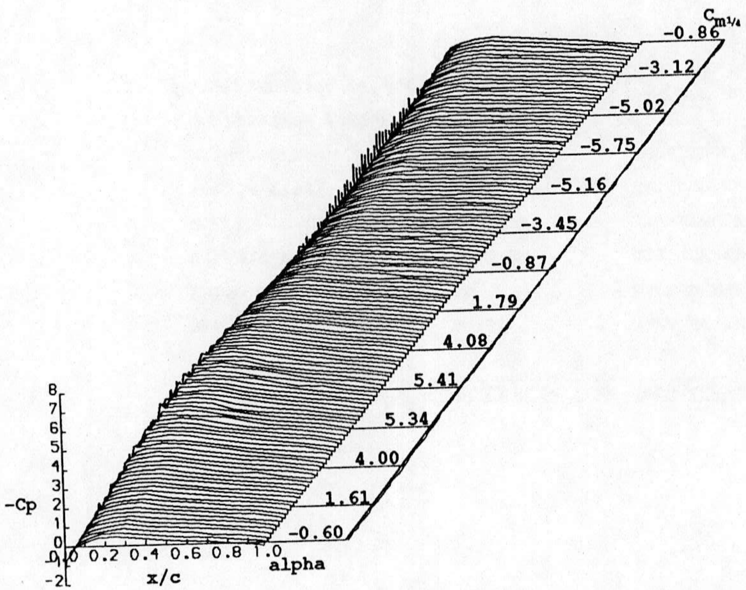


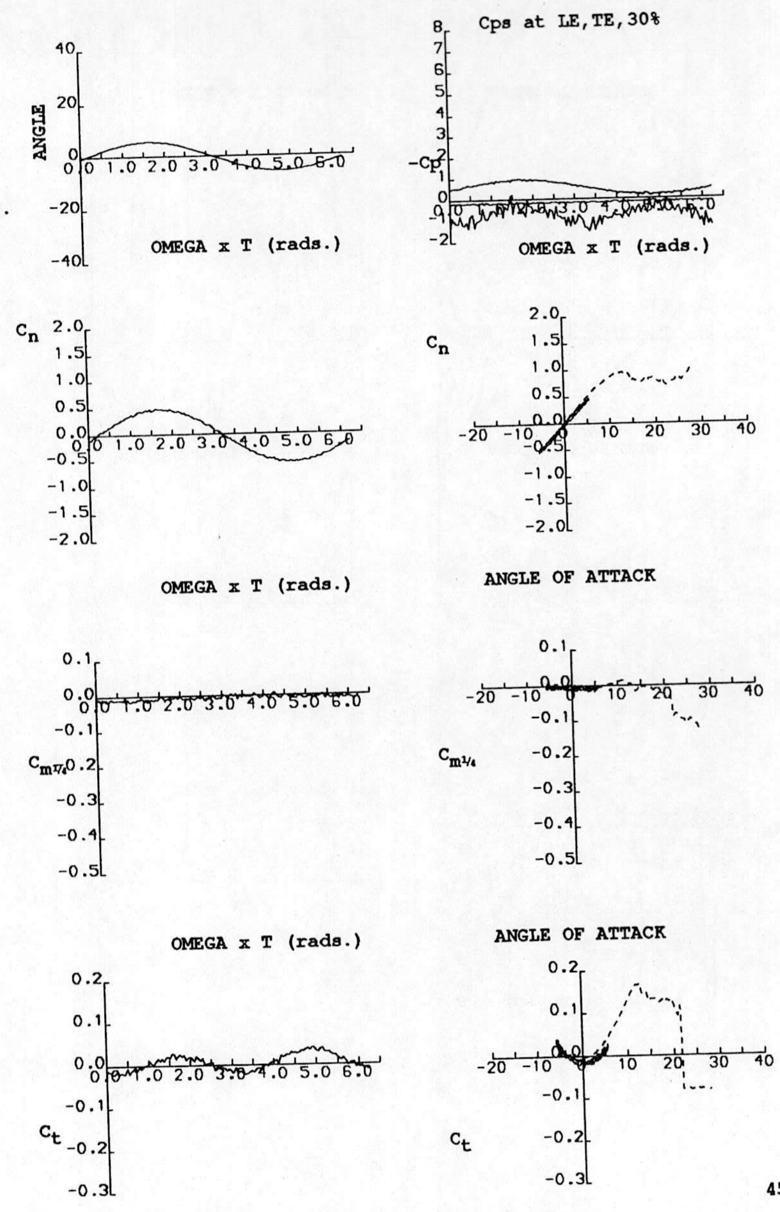


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14521
REYNOLDS NUMBER = 784103.
DYNAMIC PRESSURE = 271.76 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.651 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.062
AIR TEMPERATURE = 22.0°C
SAMPLING FREQUENCY = 83.33 Hz.
REDUCED FREQUENCY = 0.053
AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54591

REYNOLDS NUMBER = 787975.

DYNAMIC PRESSURE = 273.73 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

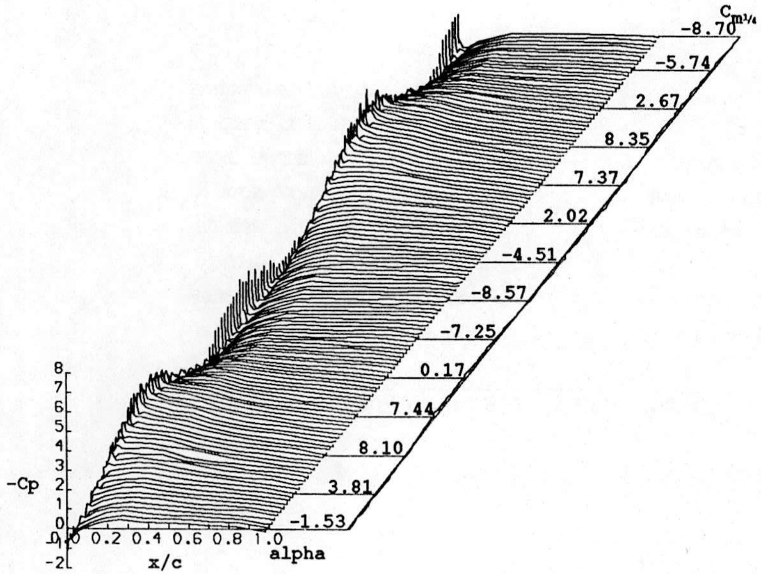
MACH NUMBER = 0.062

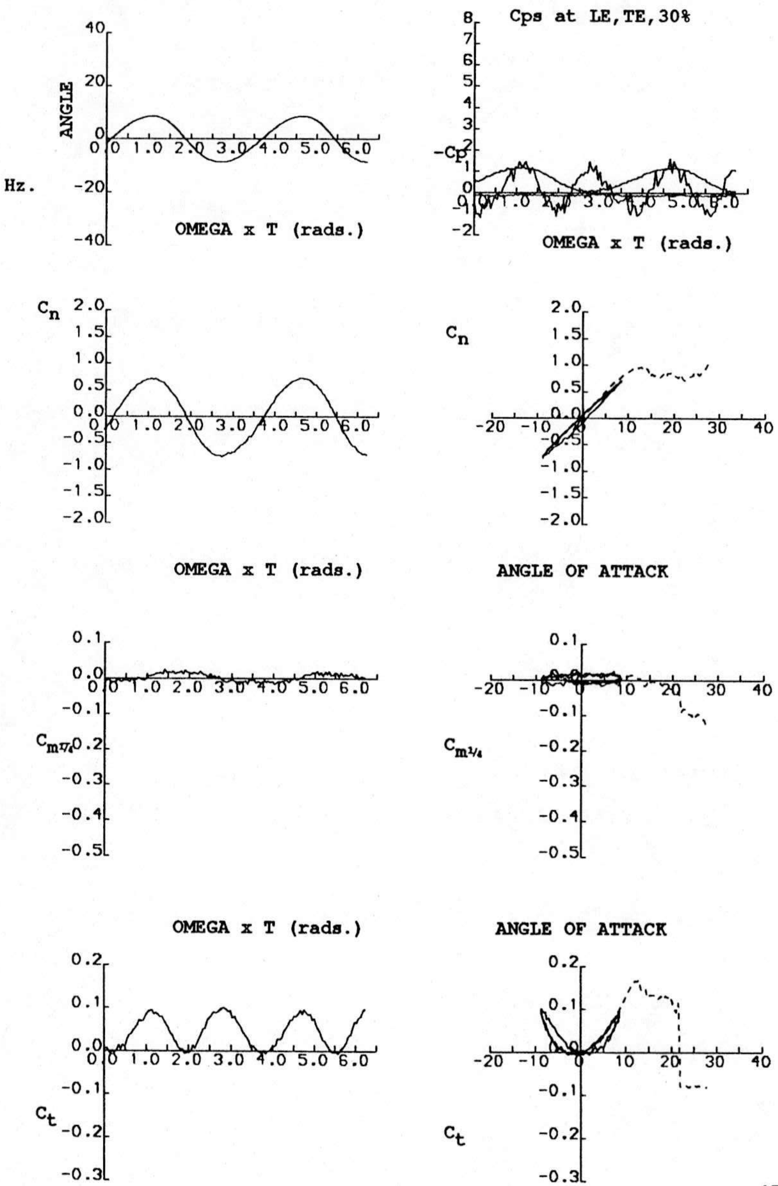
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

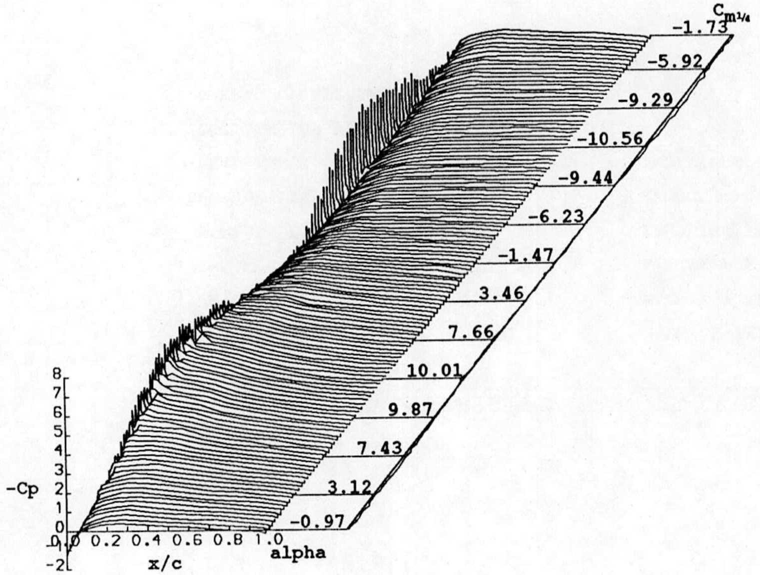
AMPLITUDE = 5.40°

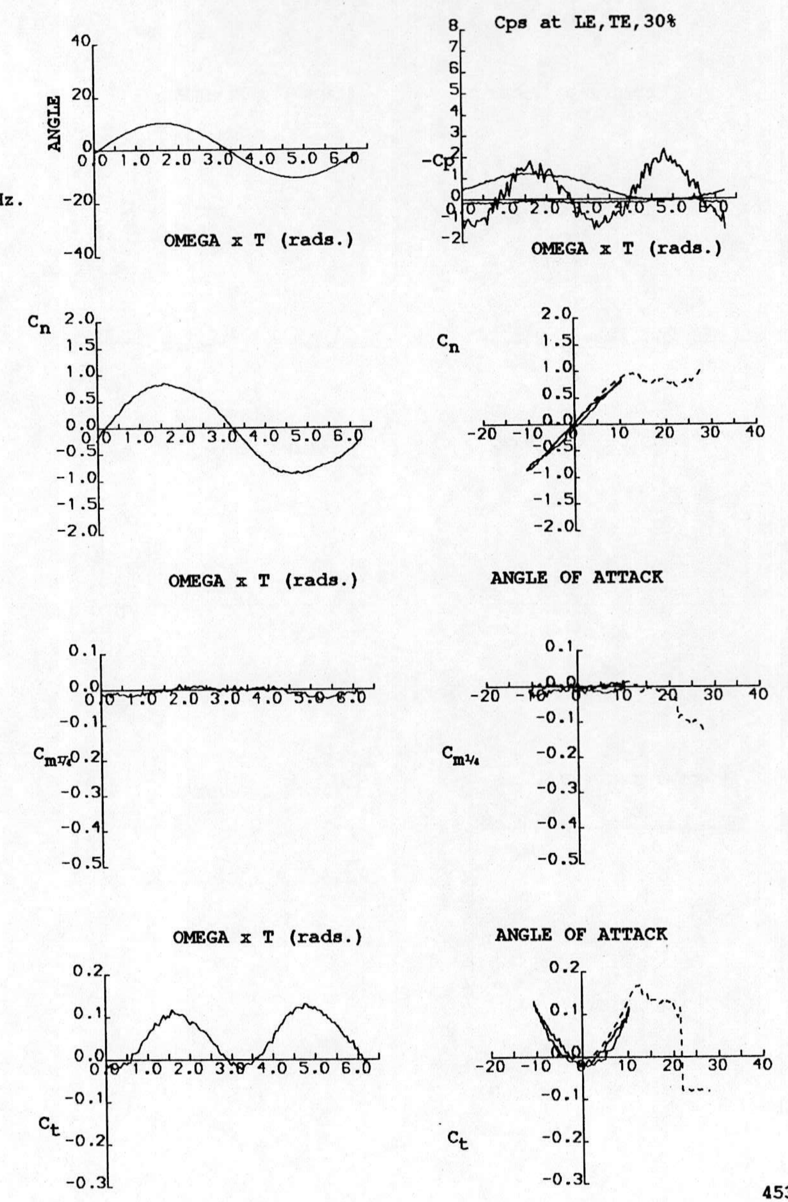




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14531	DATE OF TEST: 4/3/92
REYNOLDS NUMBER = 784103.	MACH NUMBER = 0.062
DYNAMIC PRESSURE = 271.76 Nm^{-2}	AIR TEMPERATURE = 22.0°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 83.33 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.053
MEAN ANGLE = 0.00°	AMPLITUDE = 10.00°
OSCILLATION FREQUENCY = 0.651 Hz.	
AVERAGED DATA OF 10 CYCLES	

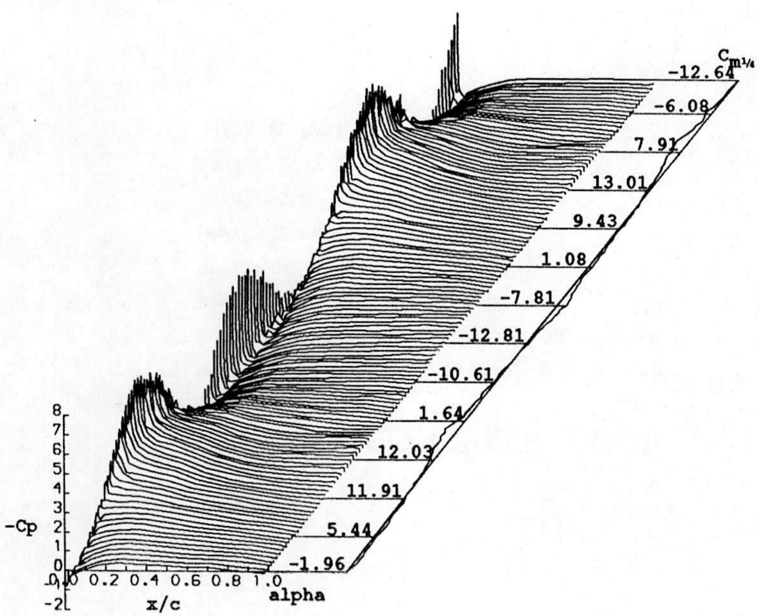


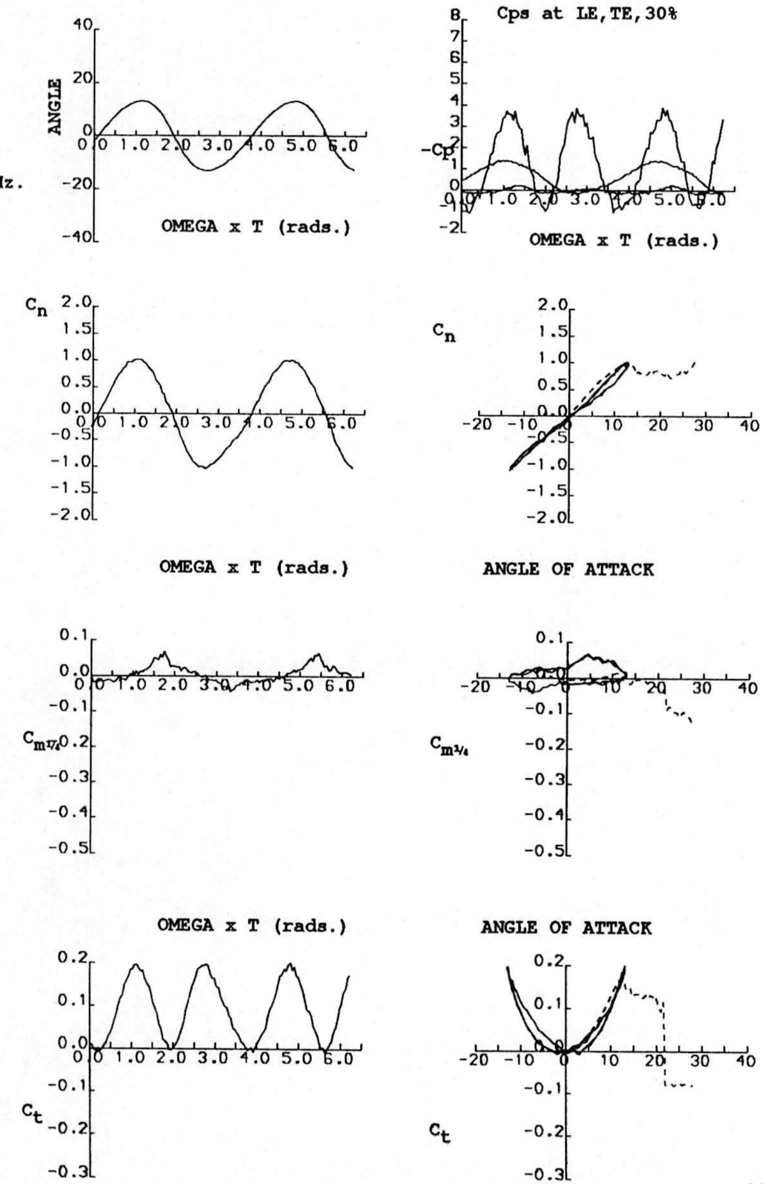


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54601
REYNOLDS NUMBER = 787975.
DYNAMIC PRESSURE = 273.73 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.651 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92
MACH NUMBER = 0.062
AIR TEMPERATURE = 21.7°C
SAMPLING FREQUENCY = 83.33 Hz.
REDUCED FREQUENCY = 0.053
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14541

REYNOLDS NUMBER = 784103.

DYNAMIC PRESSURE = 271.76 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

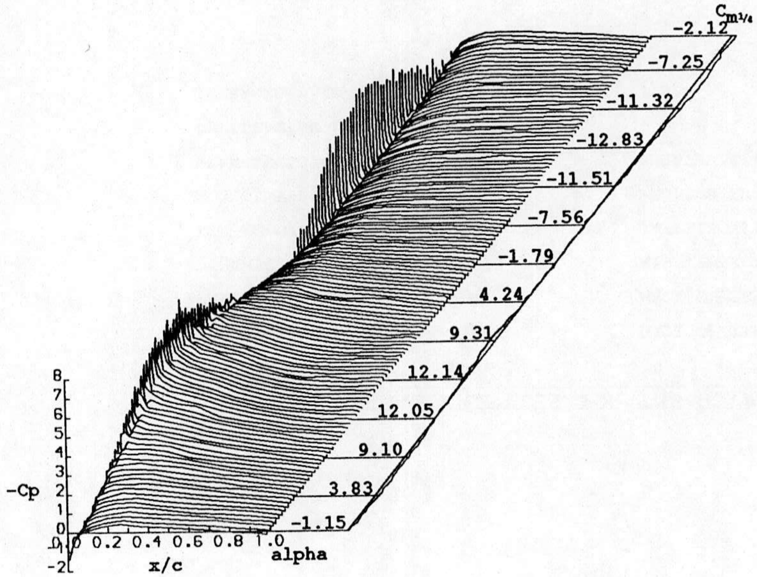
MACH NUMBER = 0.062

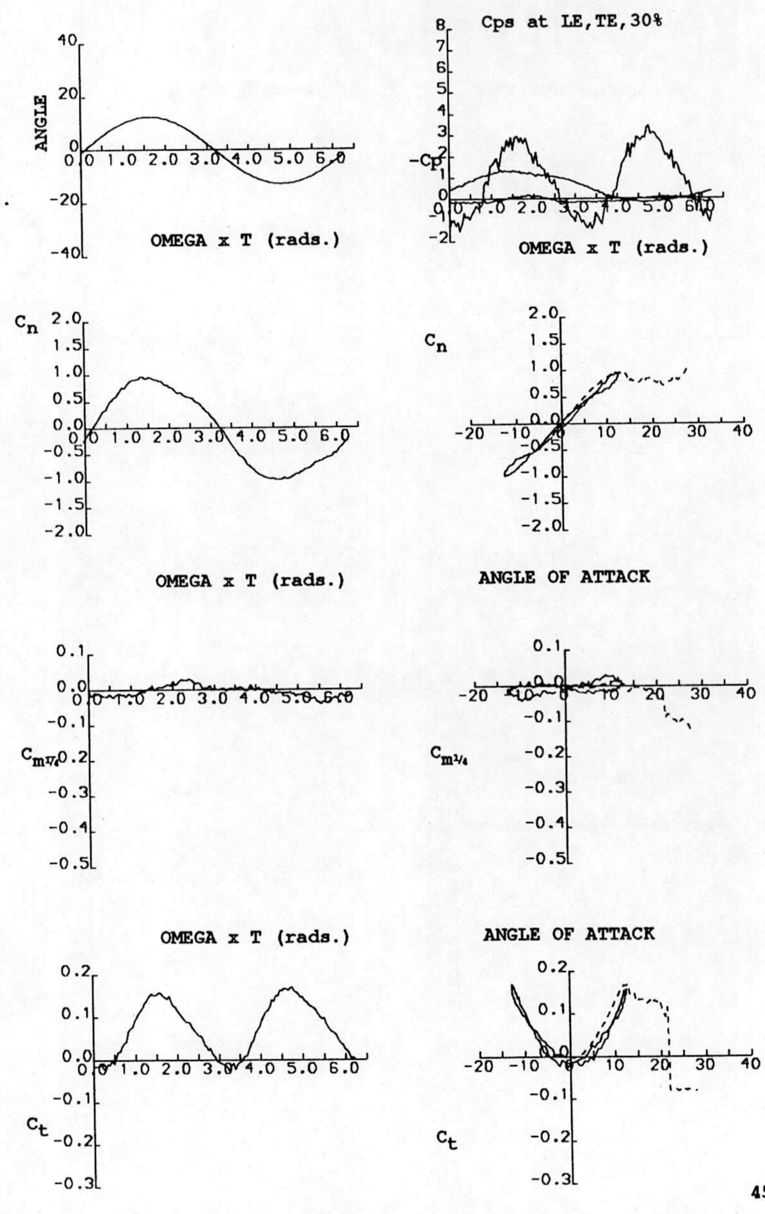
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54611

REYNOLDS NUMBER = 787975.

DYNAMIC PRESSURE = 273.73 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

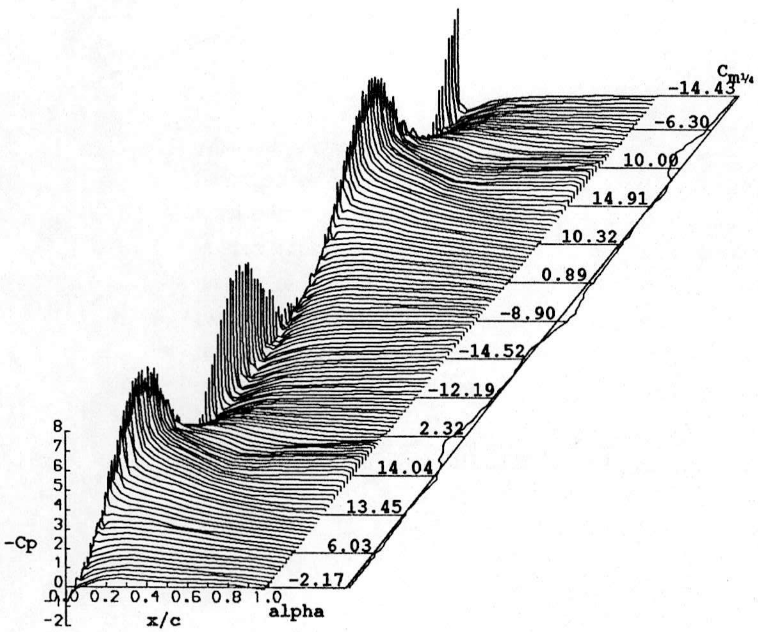
MACH NUMBER = 0.062

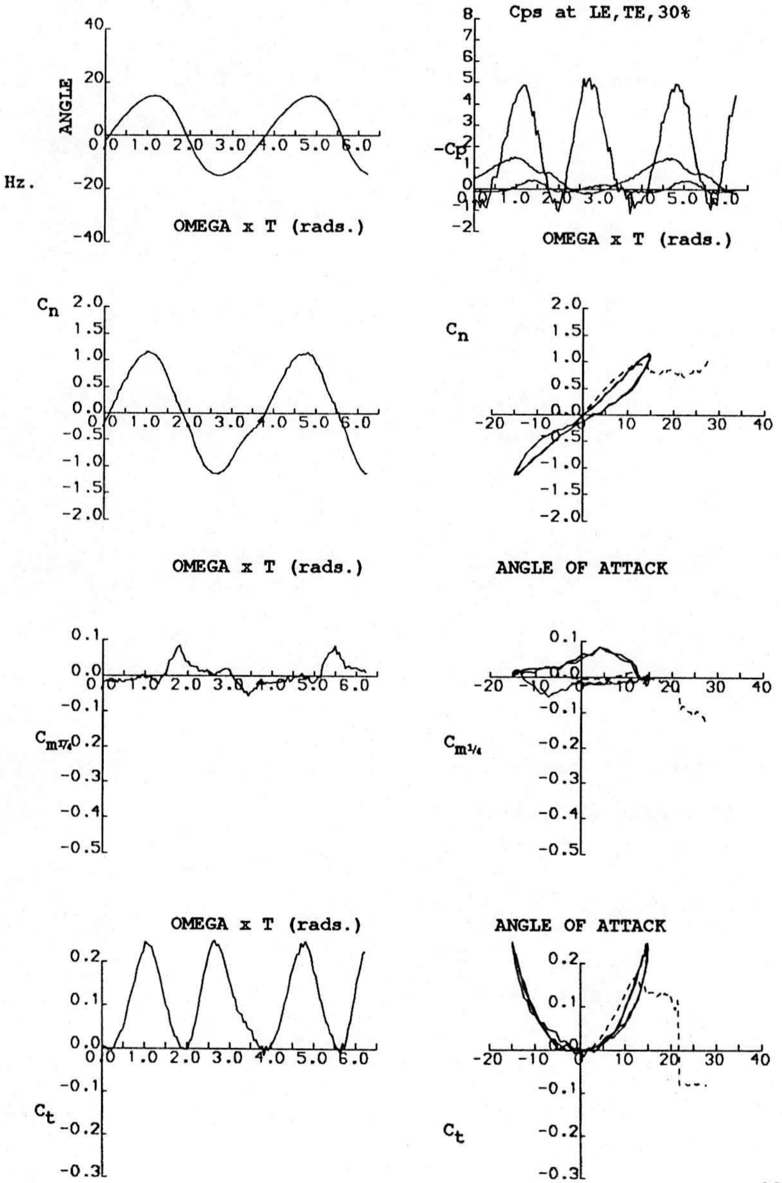
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14551

REYNOLDS NUMBER = 784103.

DYNAMIC PRESSURE = 271.76 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

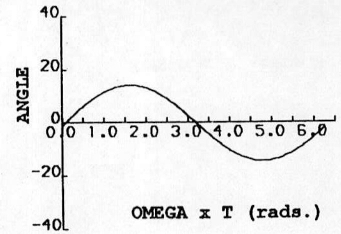
MACH NUMBER = 0.062

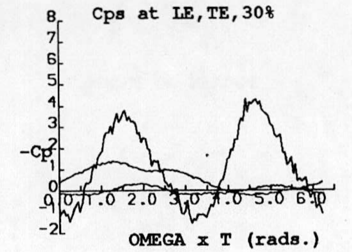
AIR TEMPERATURE = 22.0°C

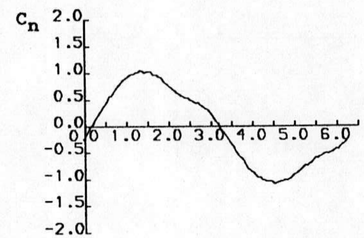
SAMPLING FREQUENCY = 83.33 Hz.

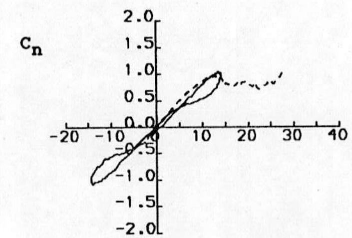
REDUCED FREQUENCY = 0.053

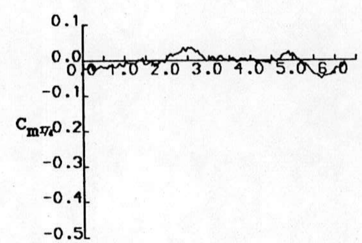
AMPLITUDE = 13.80°

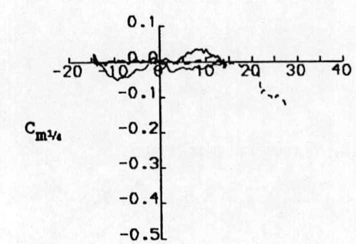


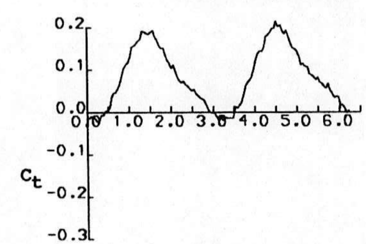


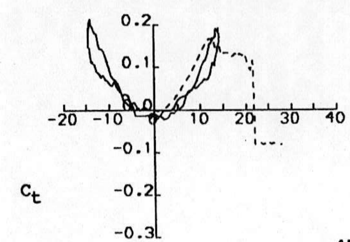


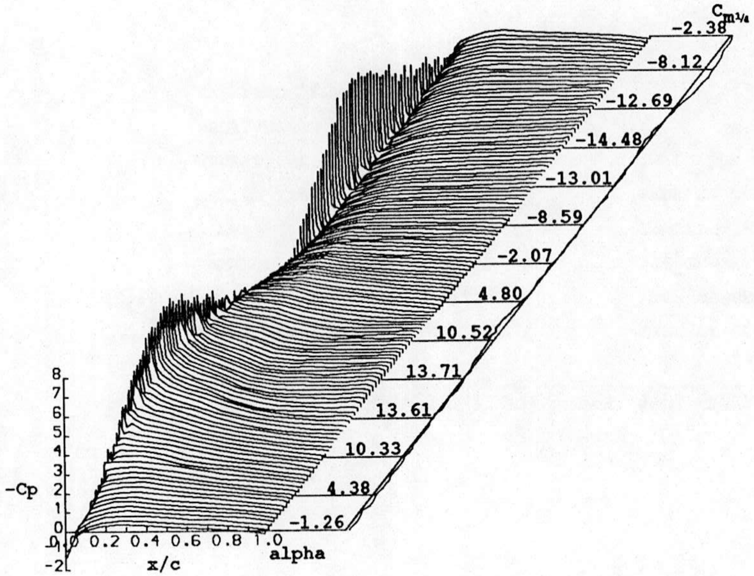












DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54621

REYNOLDS NUMBER = 787975.

DYNAMIC PRESSURE = 273.73 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

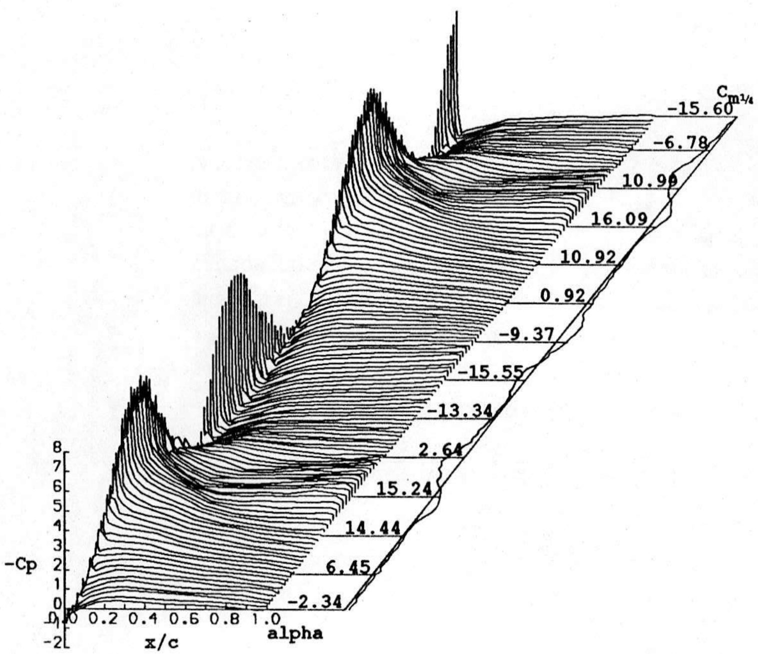
MACH NUMBER = 0.062

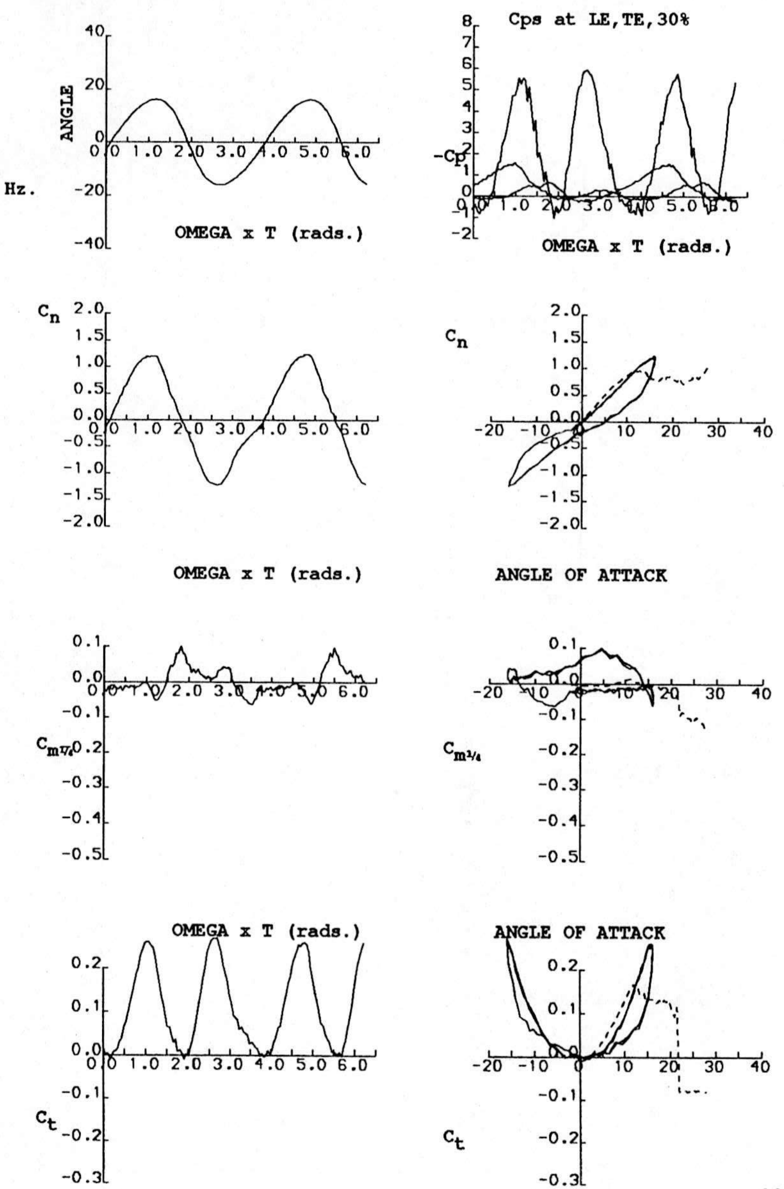
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14561

REYNOLDS NUMBER = 784103.

DYNAMIC PRESSURE = 271.76 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

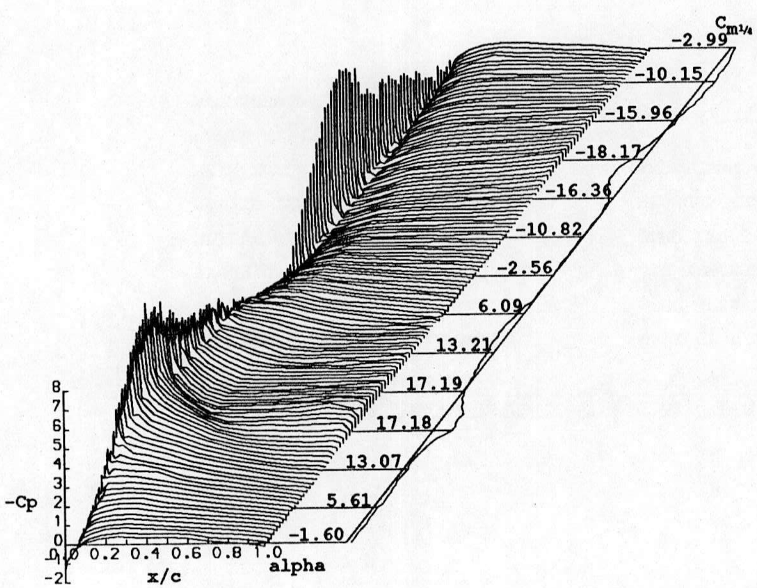
MACH NUMBER = 0.062

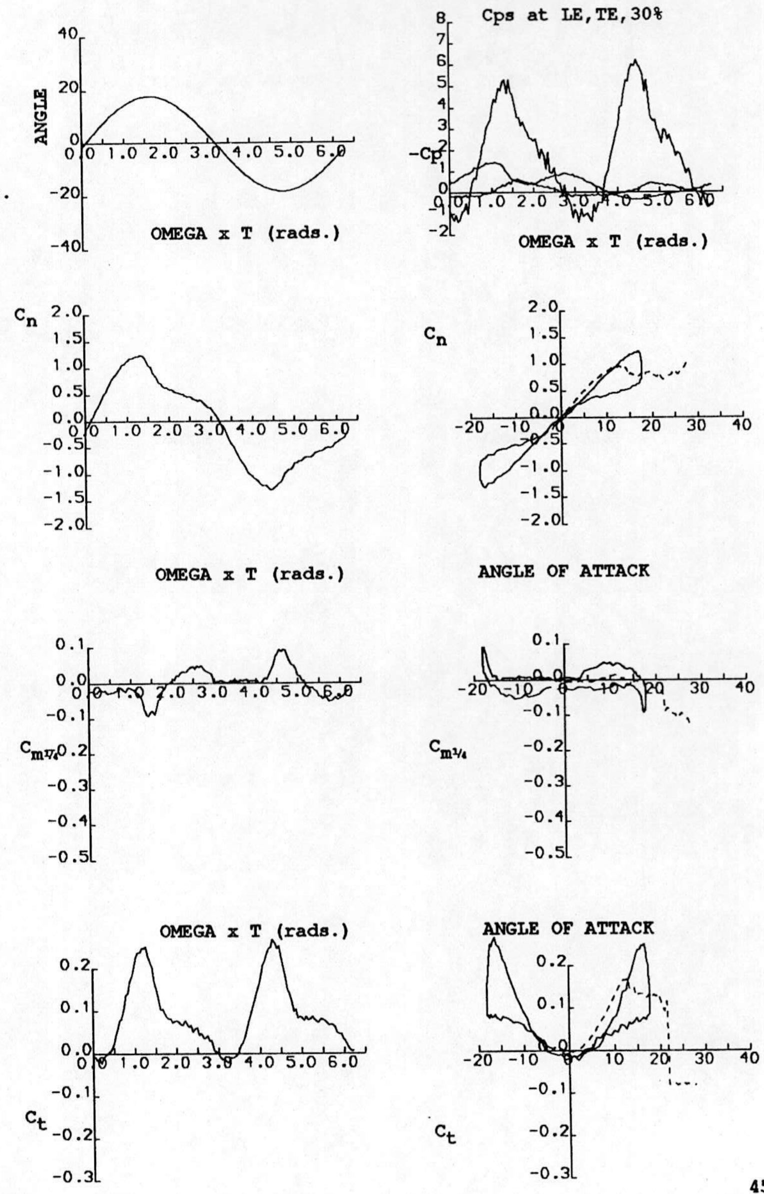
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54631

REYNOLDS NUMBER = 823063.

DYNAMIC PRESSURE = 282.55 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

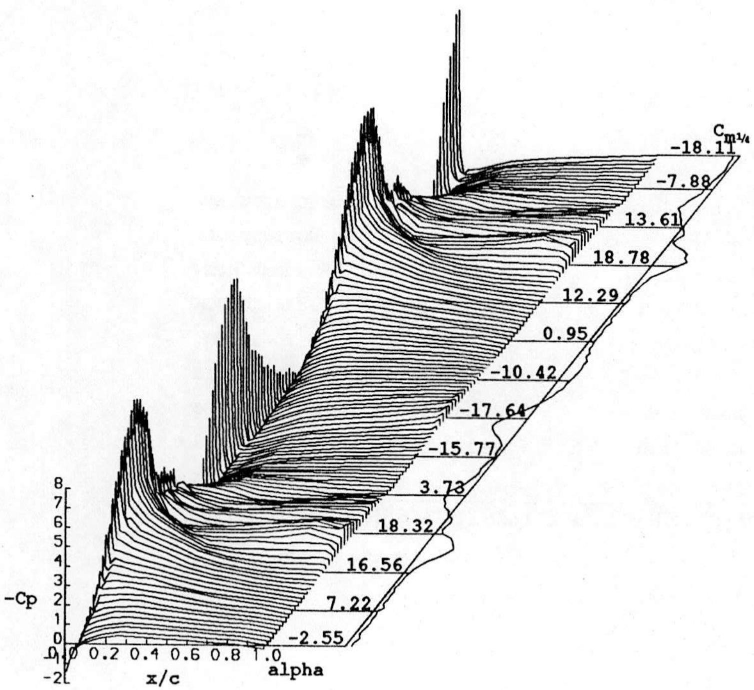
MACH NUMBER = 0.063

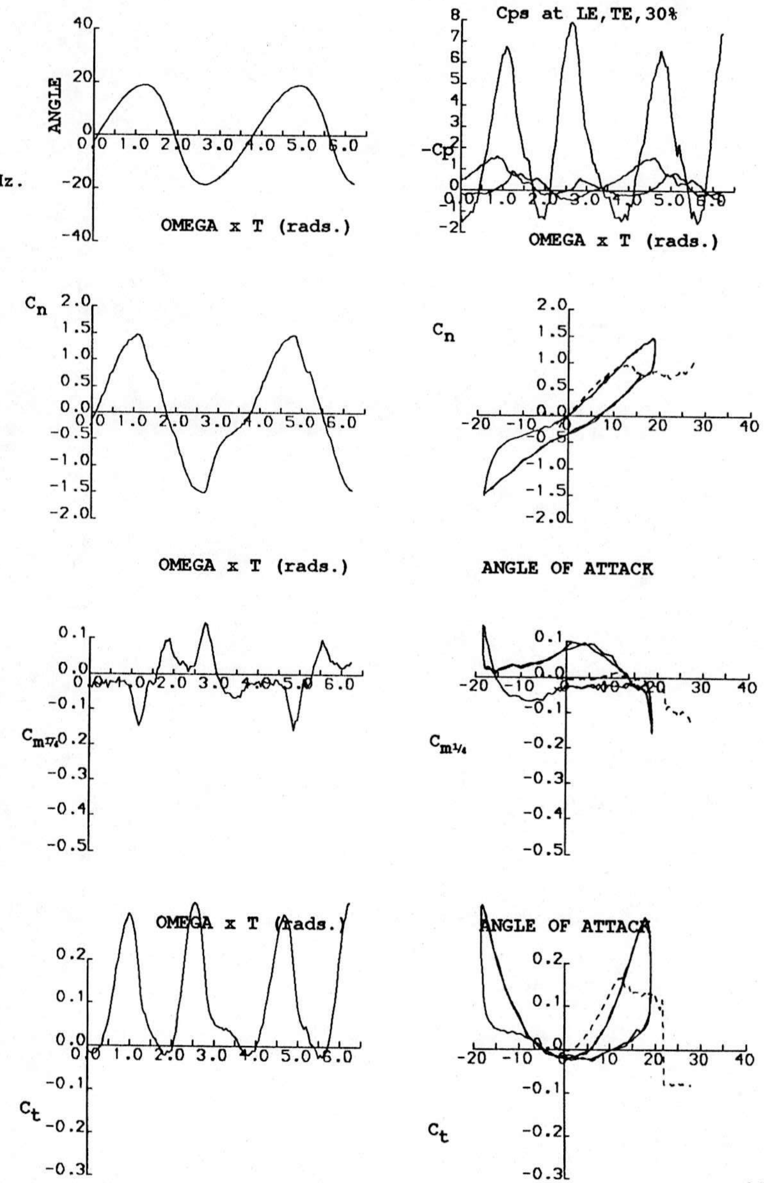
AIR TEMPERATURE = 14.9°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14571

REYNOLDS NUMBER = 784103.

DYNAMIC PRESSURE = 271.76 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

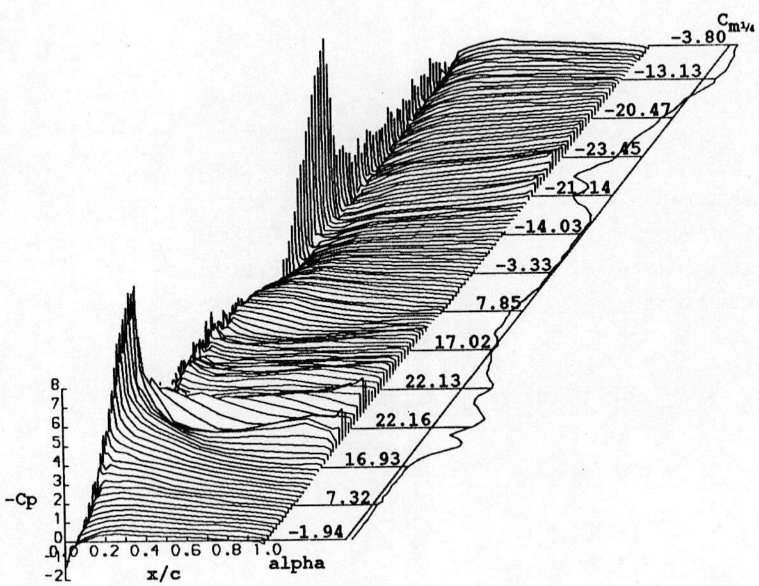
MACH NUMBER = 0.062

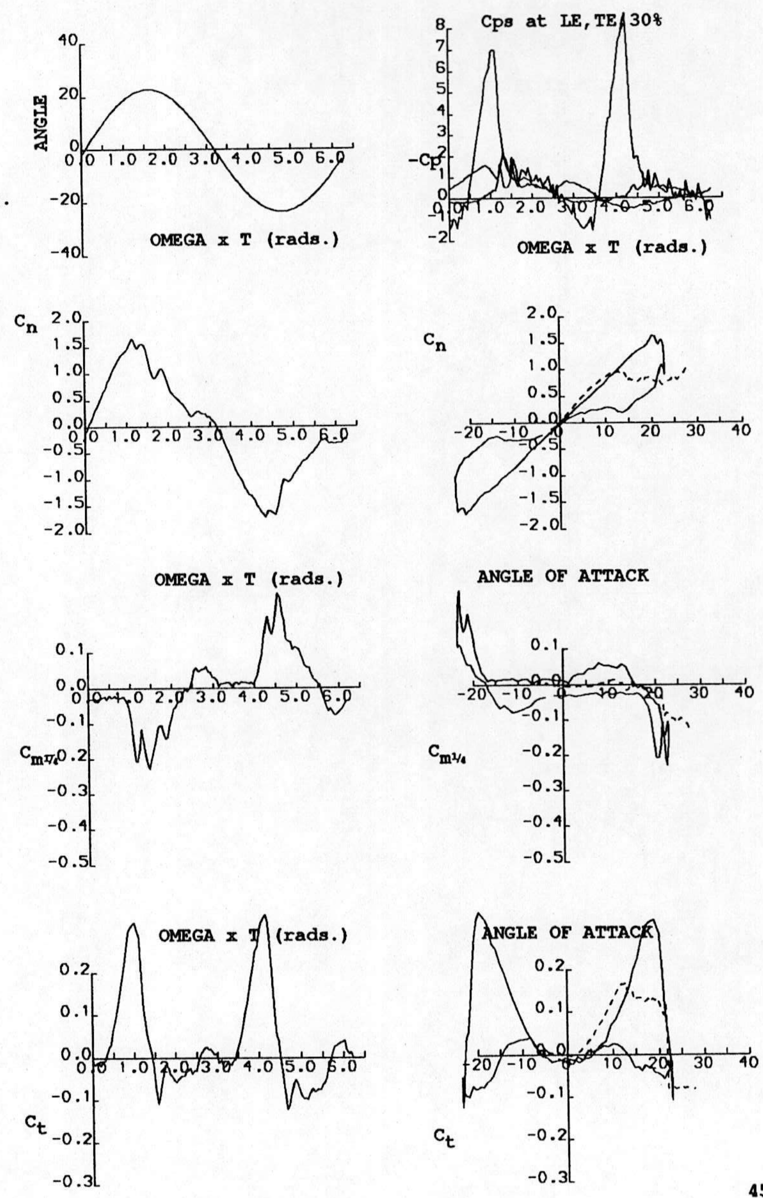
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 22.60°

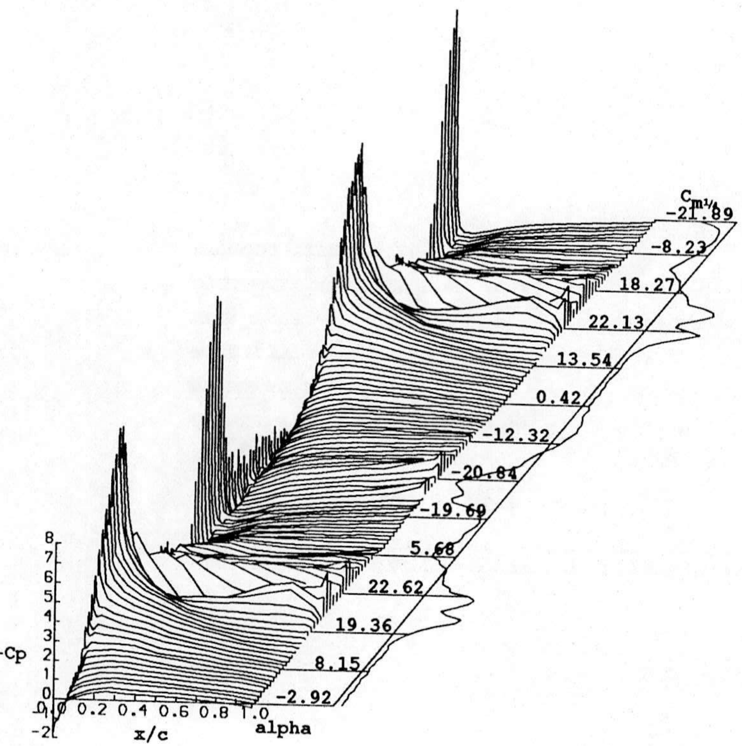


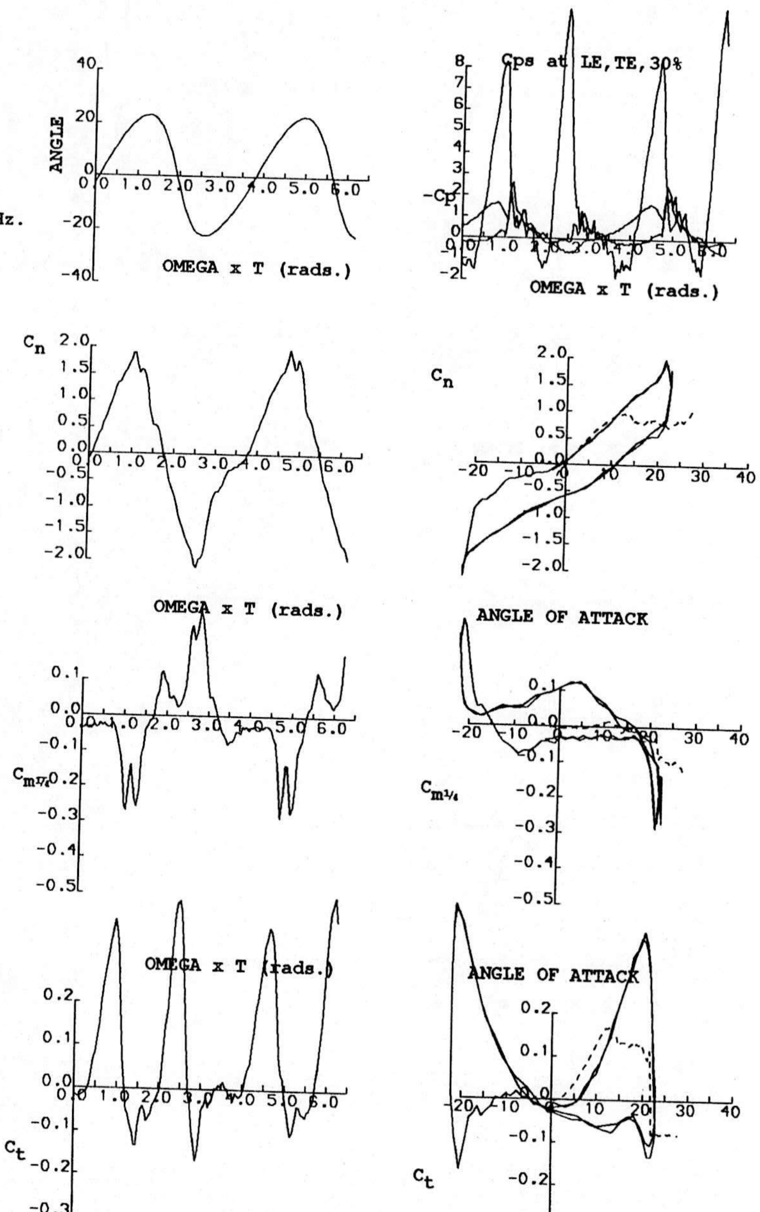


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54641
REYNOLDS NUMBER = 822694.
DYNAMIC PRESSURE = 282.55 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.651 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.063
AIR TEMPERATURE = 15.0°C
SAMPLING FREQUENCY = 83.33 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14581

REYNOLDS NUMBER = 784103.

DYNAMIC PRESSURE = 271.76 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/3/92

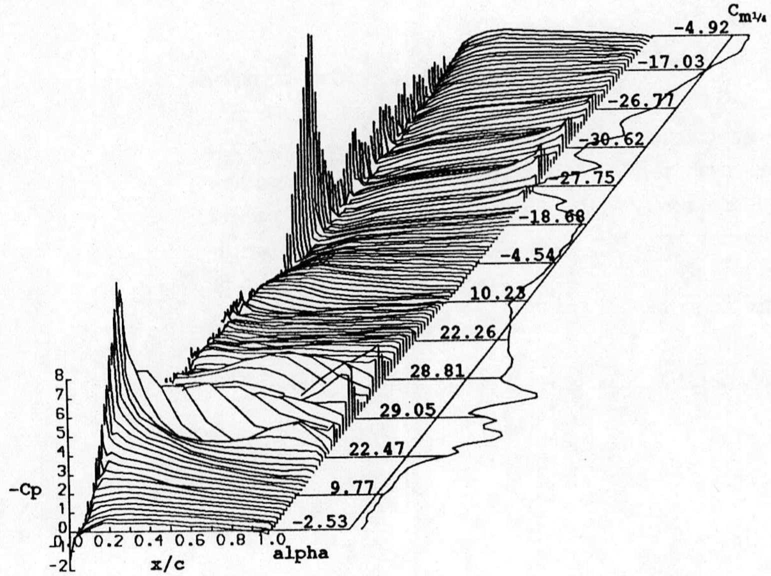
MACH NUMBER = 0.062

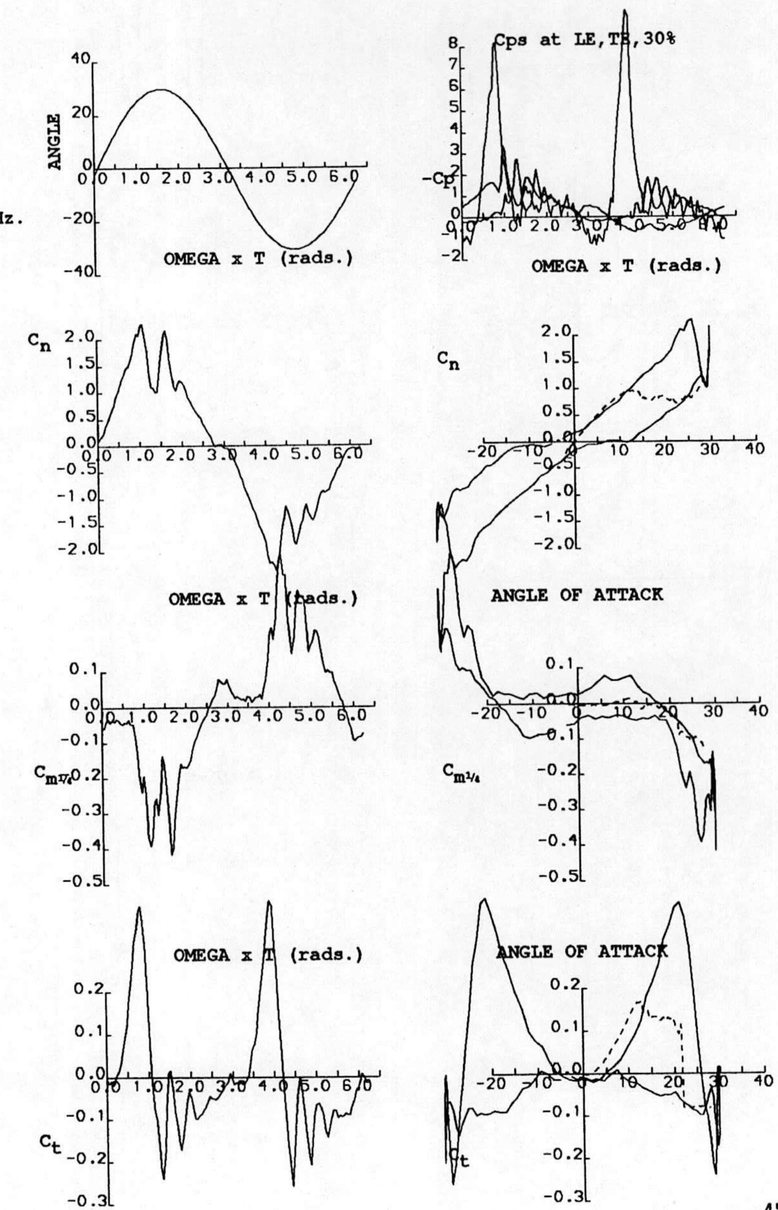
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 30.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54651

REYNOLDS NUMBER = 822694.

DYNAMIC PRESSURE = 282.55 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.651 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

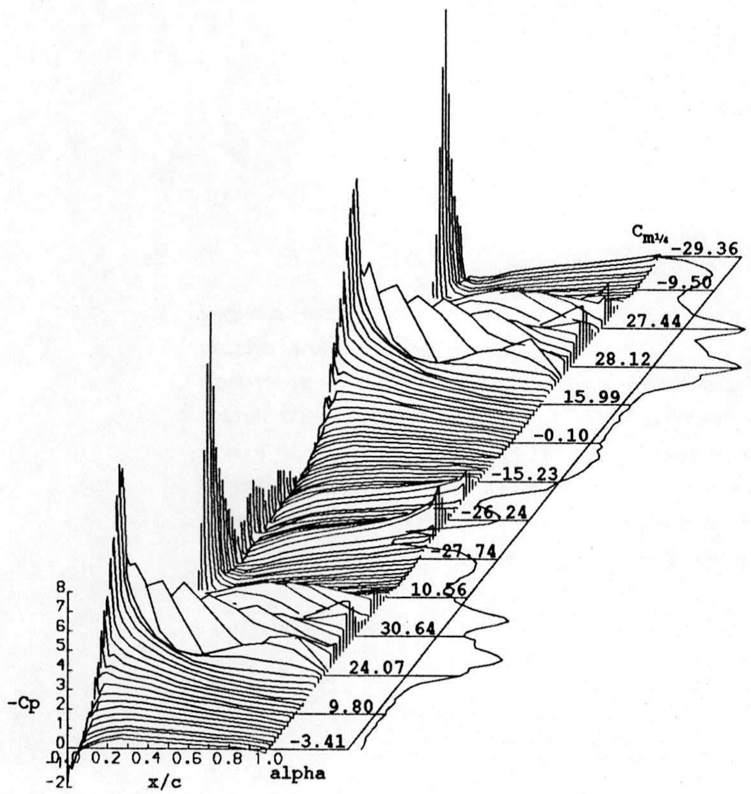
MACH NUMBER = 0.063

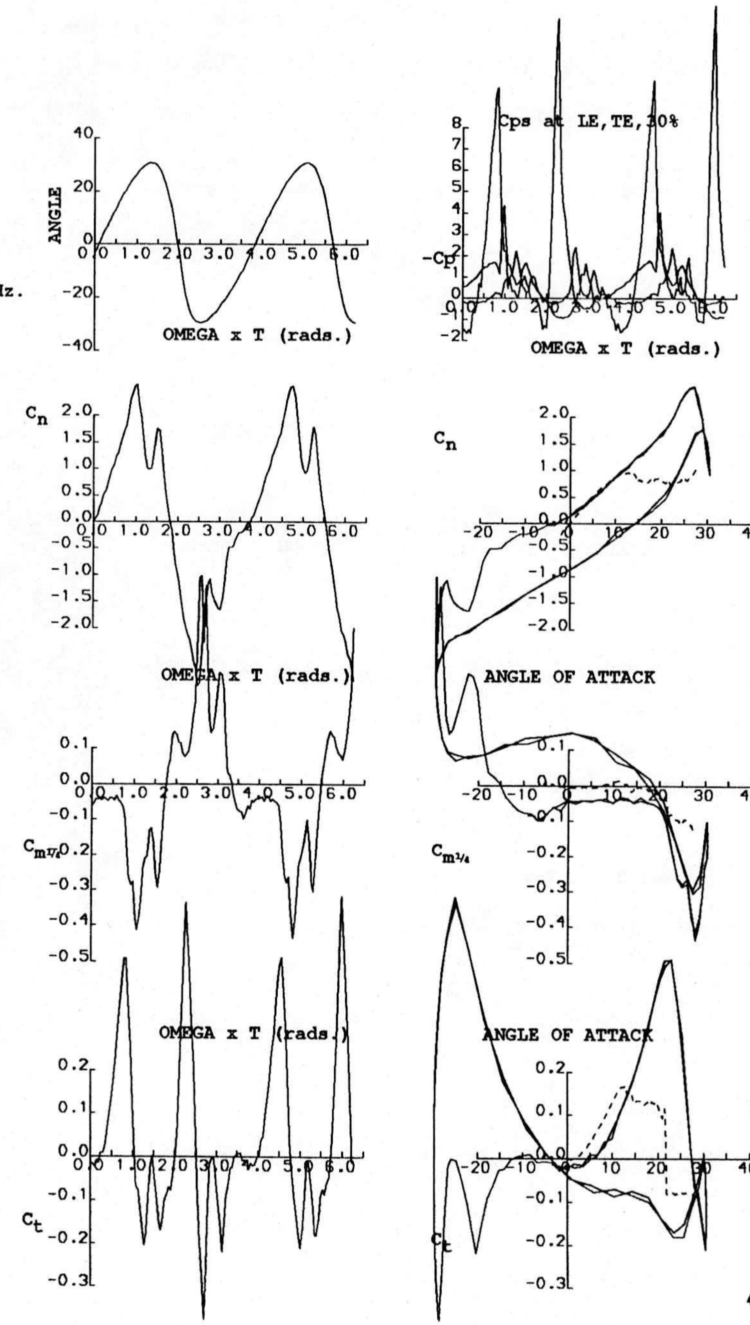
AIR TEMPERATURE = 15.0°C

SAMPLING FREQUENCY = 83.33 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 30.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14671

REYNOLDS NUMBER = 1505427.

DYNAMIC PRESSURE = 967.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

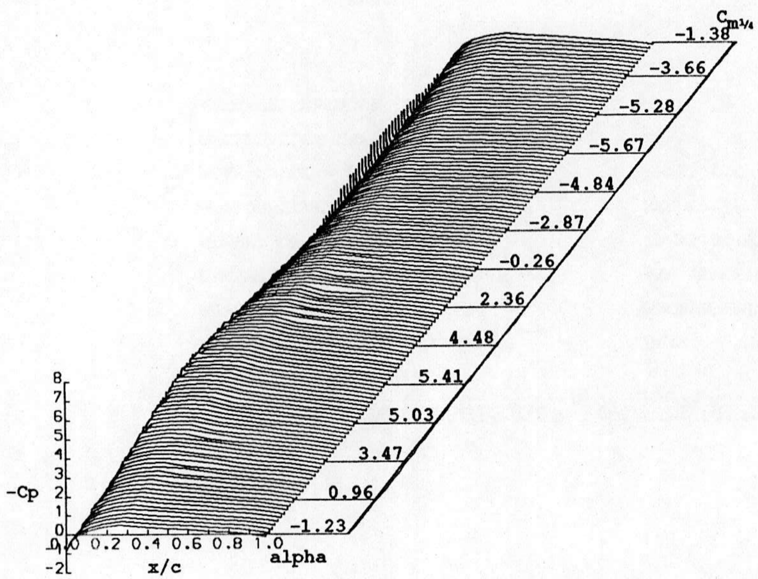
MACH NUMBER = 0.117

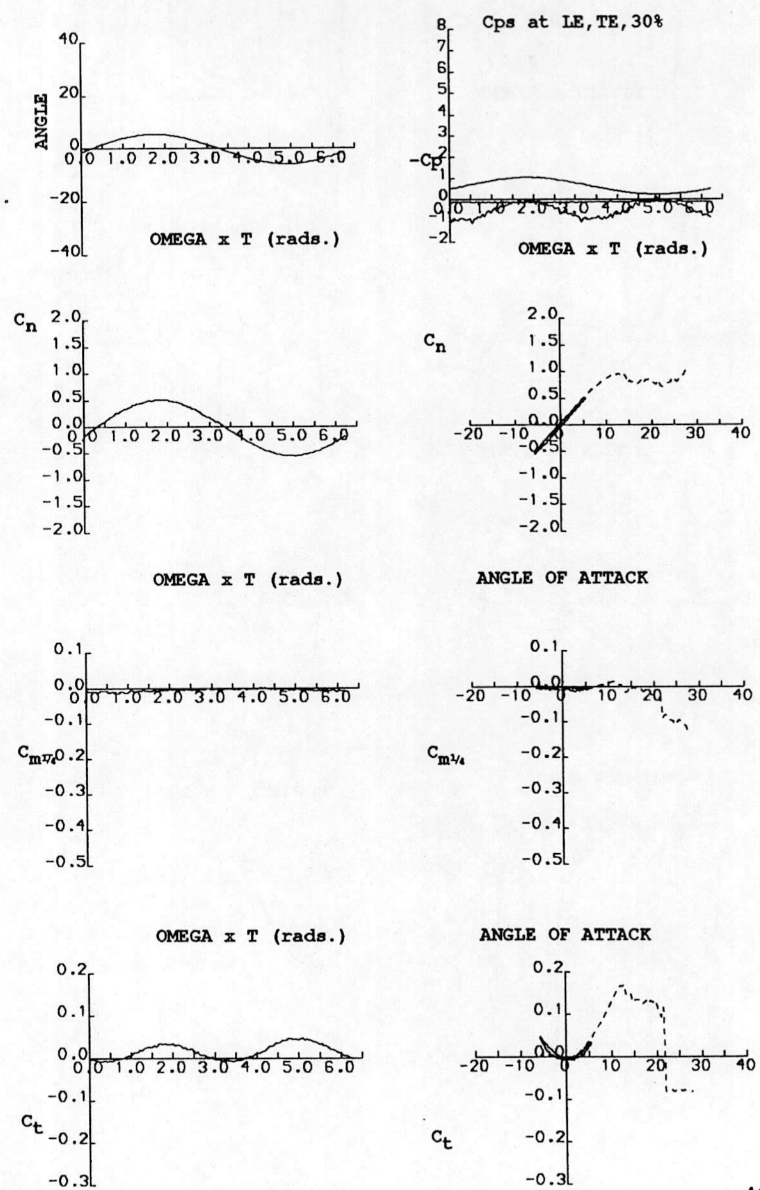
AIR TEMPERATURE = 17.5°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 5.40°

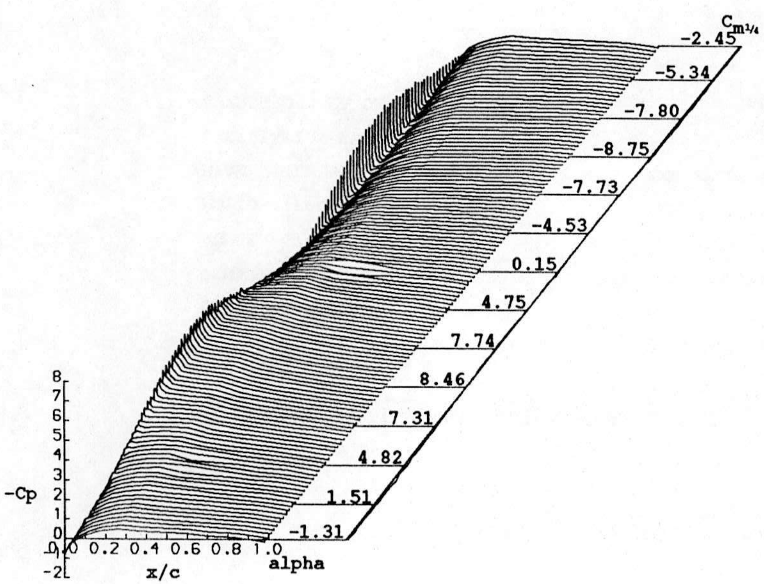


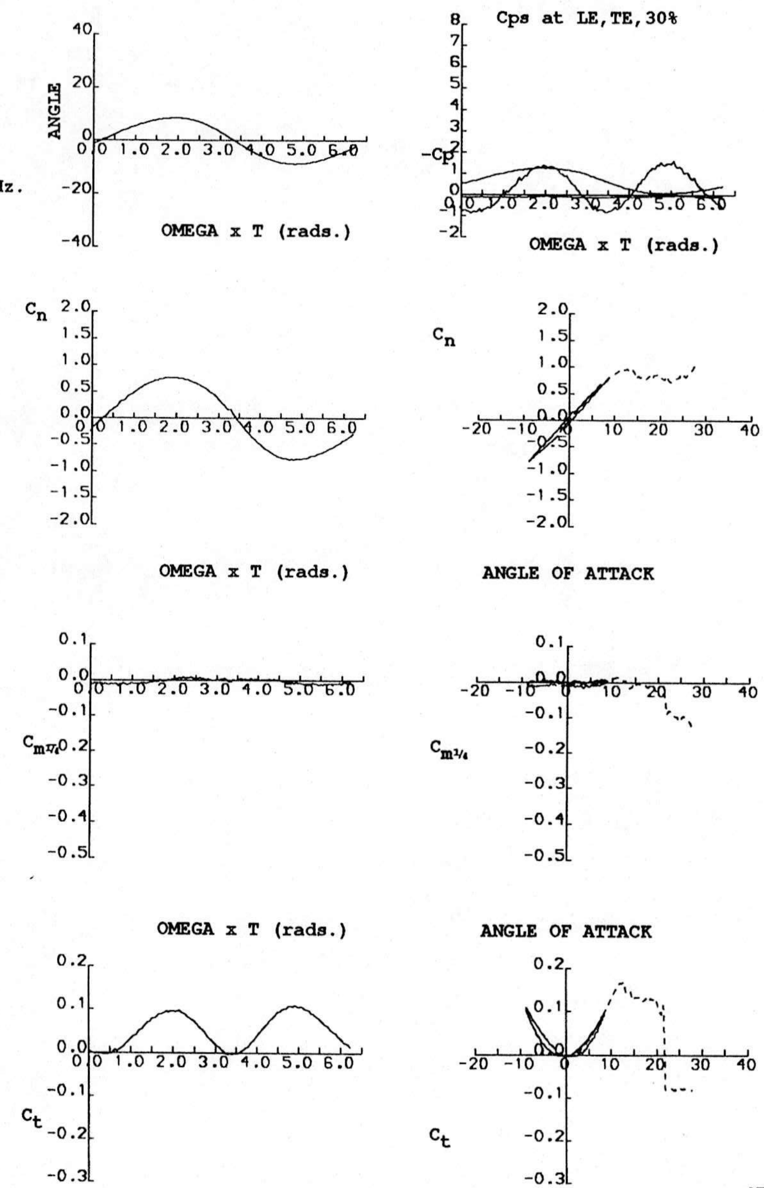


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54741
REYNOLDS NUMBER = 1513436.
DYNAMIC PRESSURE = 986.39 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.219 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 18.5°C
SAMPLING FREQUENCY = 156.03 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 5.40°

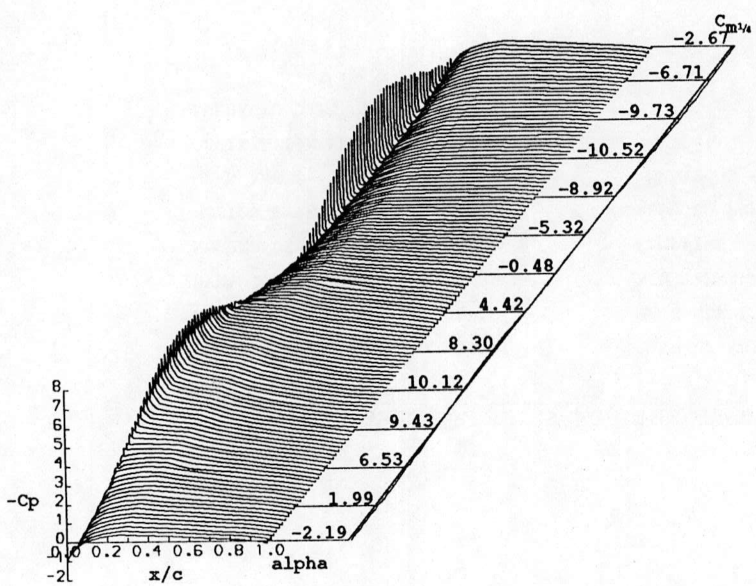


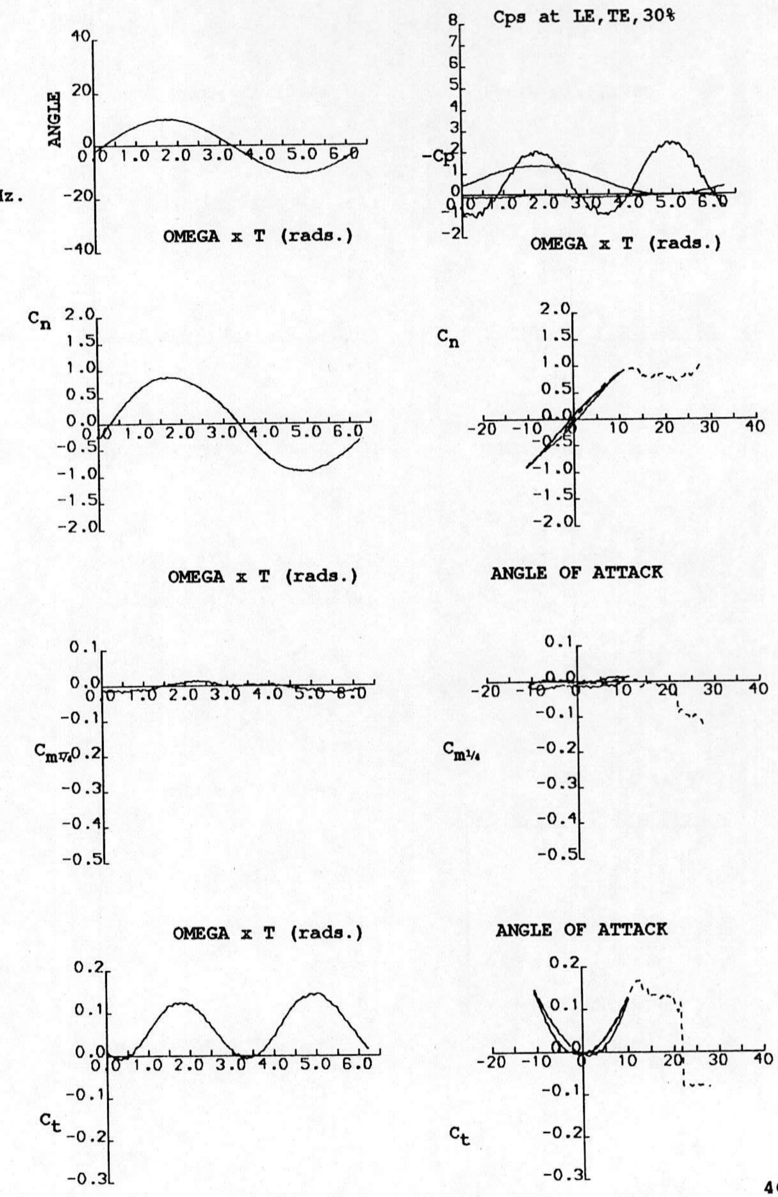


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14681
REYNOLDS NUMBER = 1502101.
DYNAMIC PRESSURE = 967.39 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.219 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 18.0°C
SAMPLING FREQUENCY = 156.03 Hz.
REDUCED FREQUENCY = 0.053
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54751

REYNOLDS NUMBER = 1509441.

DYNAMIC PRESSURE = 986.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

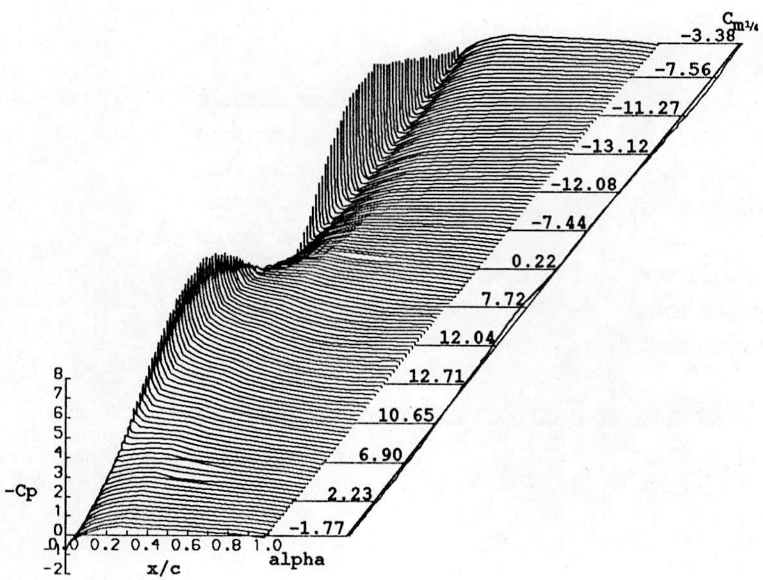
MACH NUMBER = 0.118

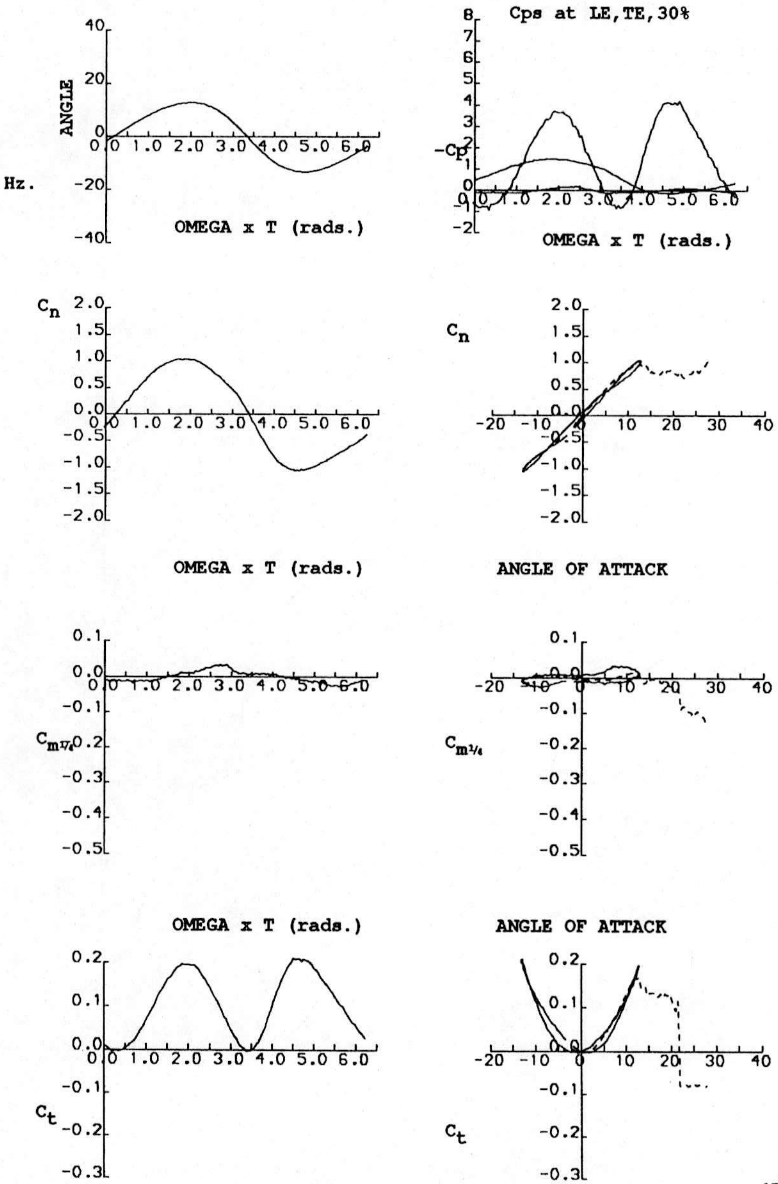
AIR TEMPERATURE = 19.1°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.052

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14691

REYNOLDS NUMBER = 1500112.

DYNAMIC PRESSURE = 967.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

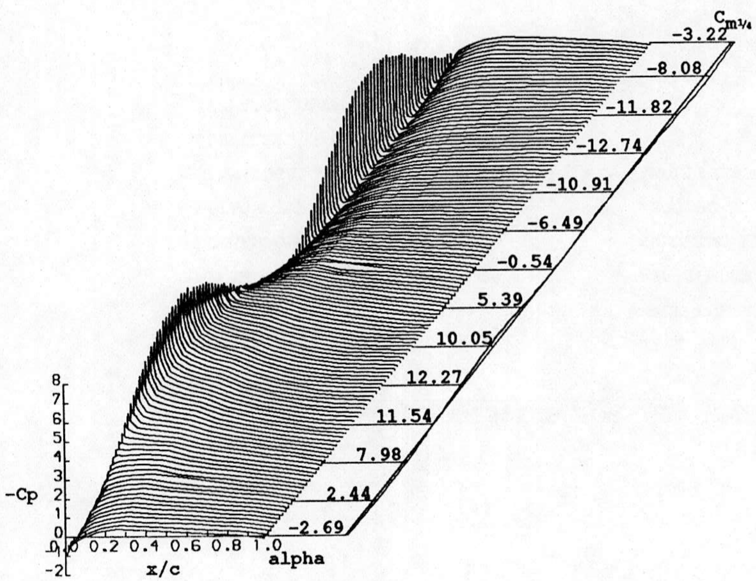
MACH NUMBER = 0.117

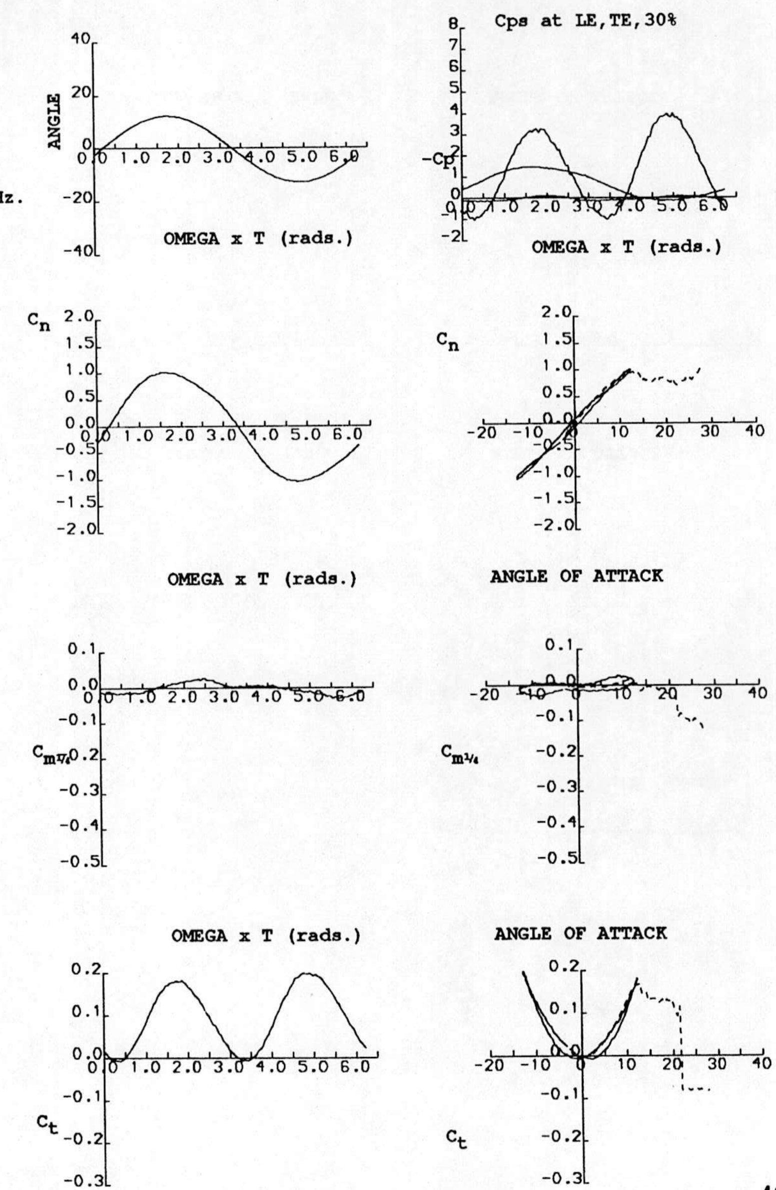
AIR TEMPERATURE = 18.3°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.053

AMPLITUDE = 12.20°

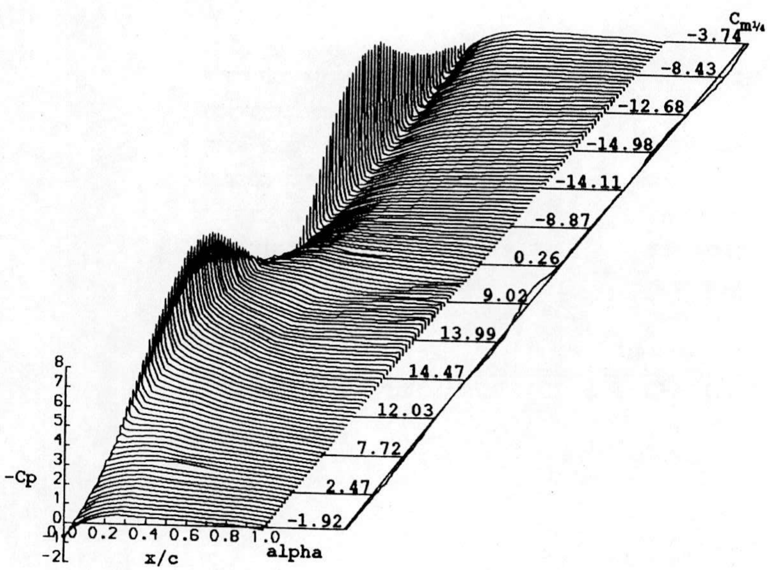


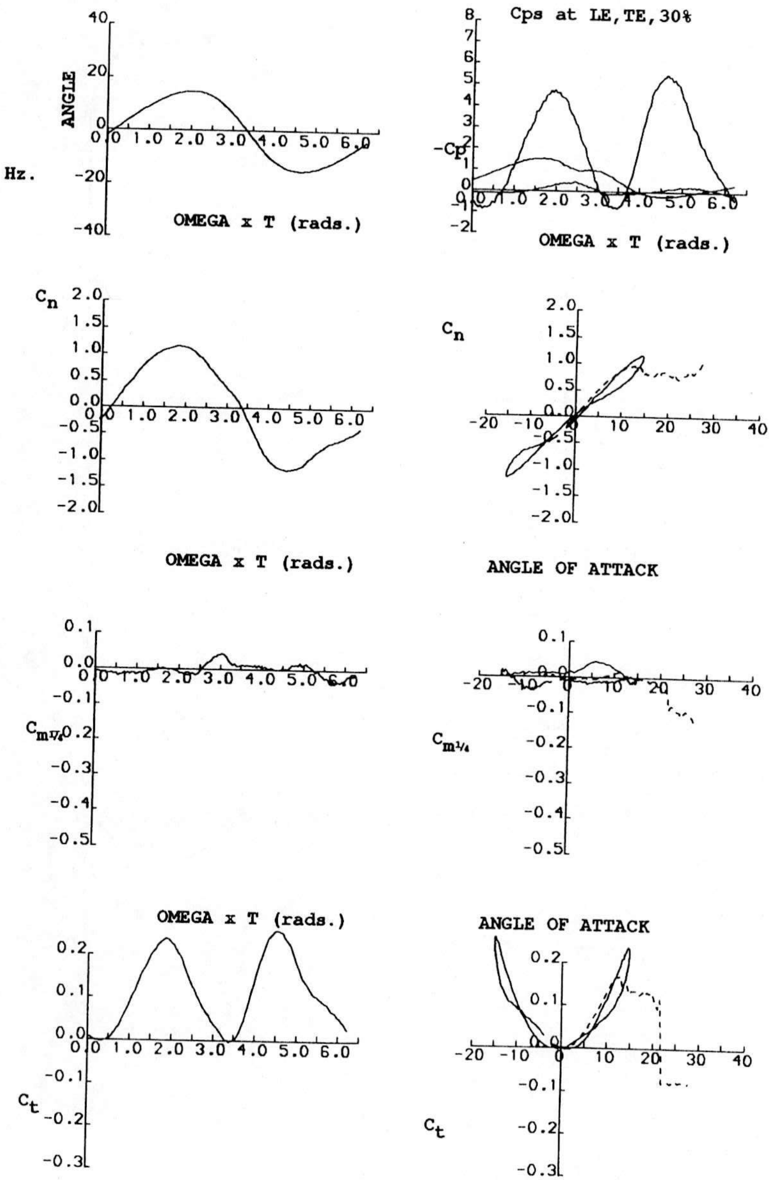


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54761
REYNOLDS NUMBER = 1507451.
DYNAMIC PRESSURE = 986.39 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.219 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 19.4°C
SAMPLING FREQUENCY = 156.03 Hz.
REDUCED FREQUENCY = 0.052
AMPLITUDE = 12.20°

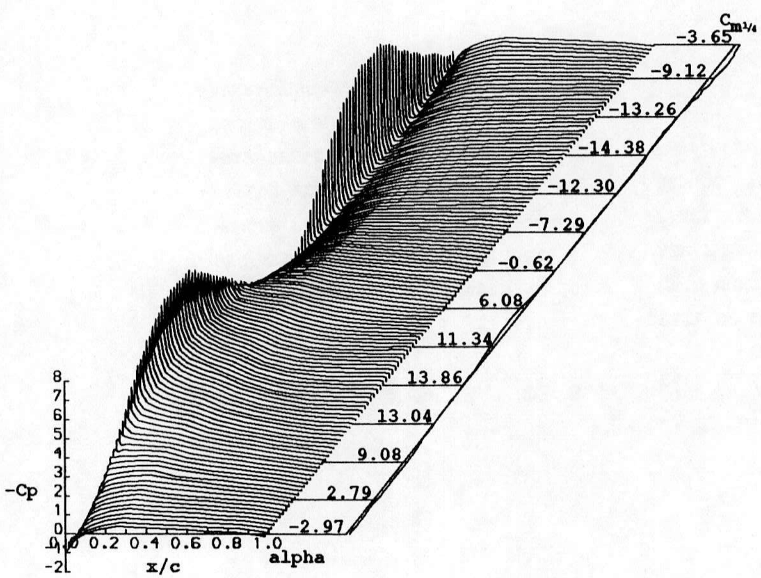


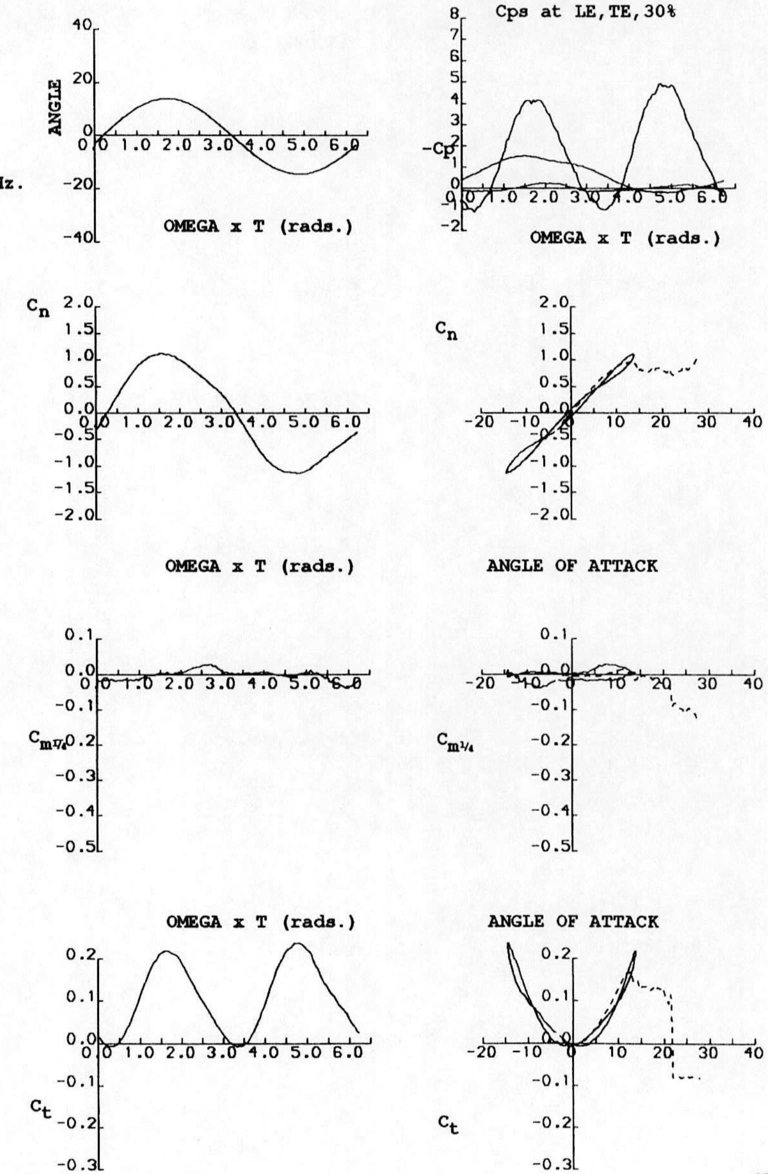


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14701
REYNOLDS NUMBER = 1498789.
DYNAMIC PRESSURE = 967.39 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.219 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 18.5°C
SAMPLING FREQUENCY = 156.03 Hz.
REDUCED FREQUENCY = 0.053
AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54771

REYNOLDS NUMBER = 1505466.

DYNAMIC PRESSURE = 986.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

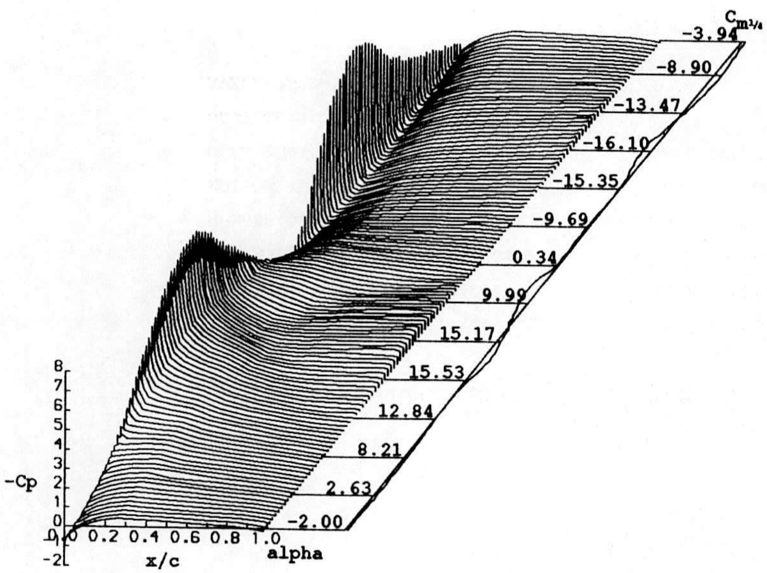
MACH NUMBER = 0.118

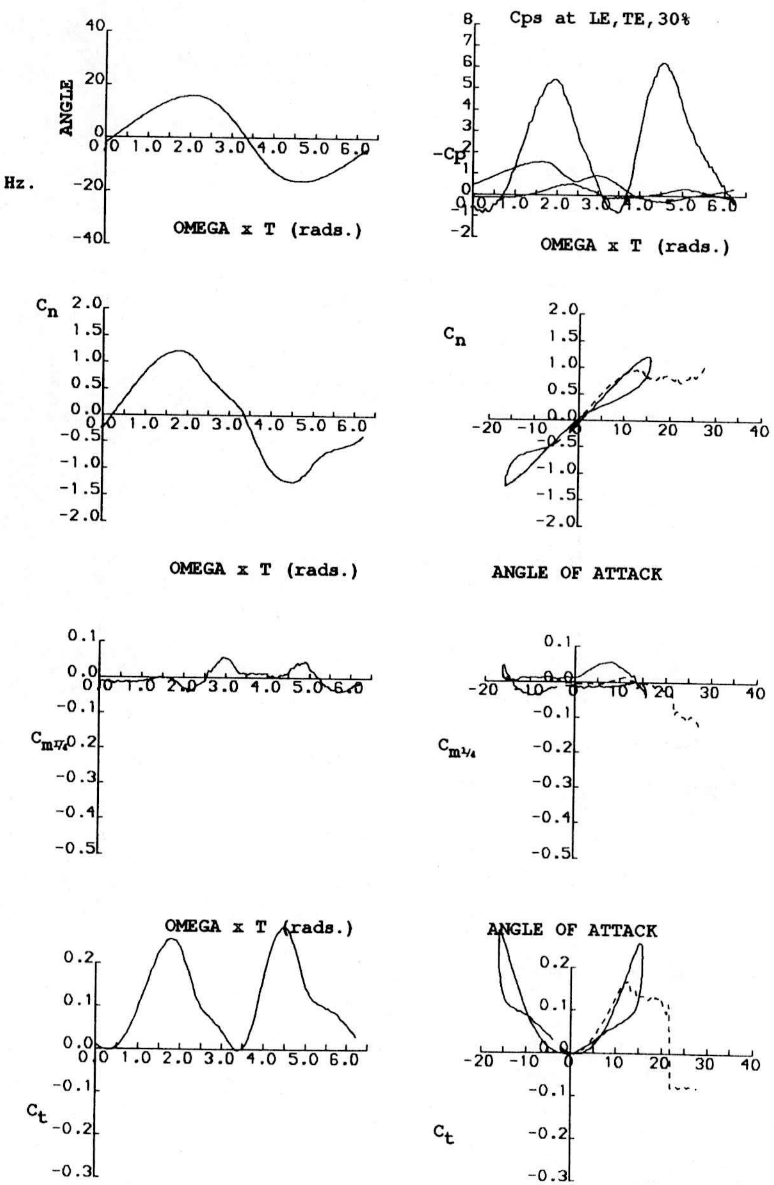
AIR TEMPERATURE = 19.7°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.052

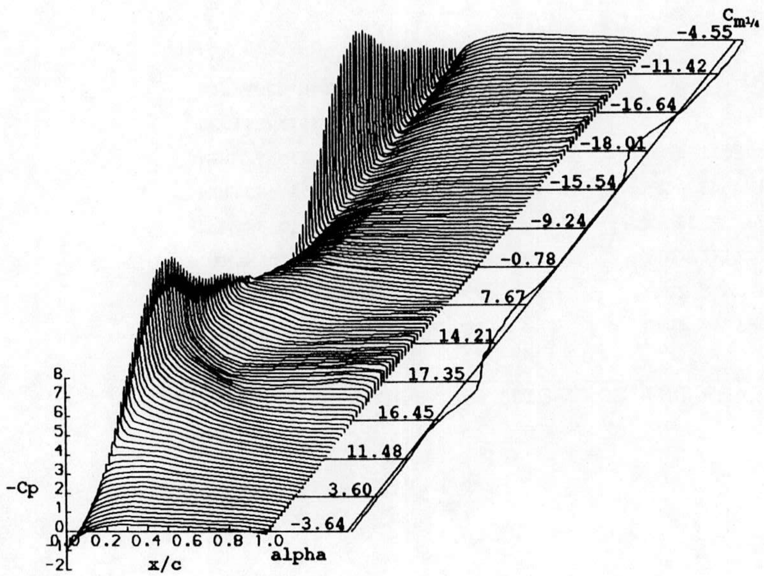
AMPLITUDE = 13.80°

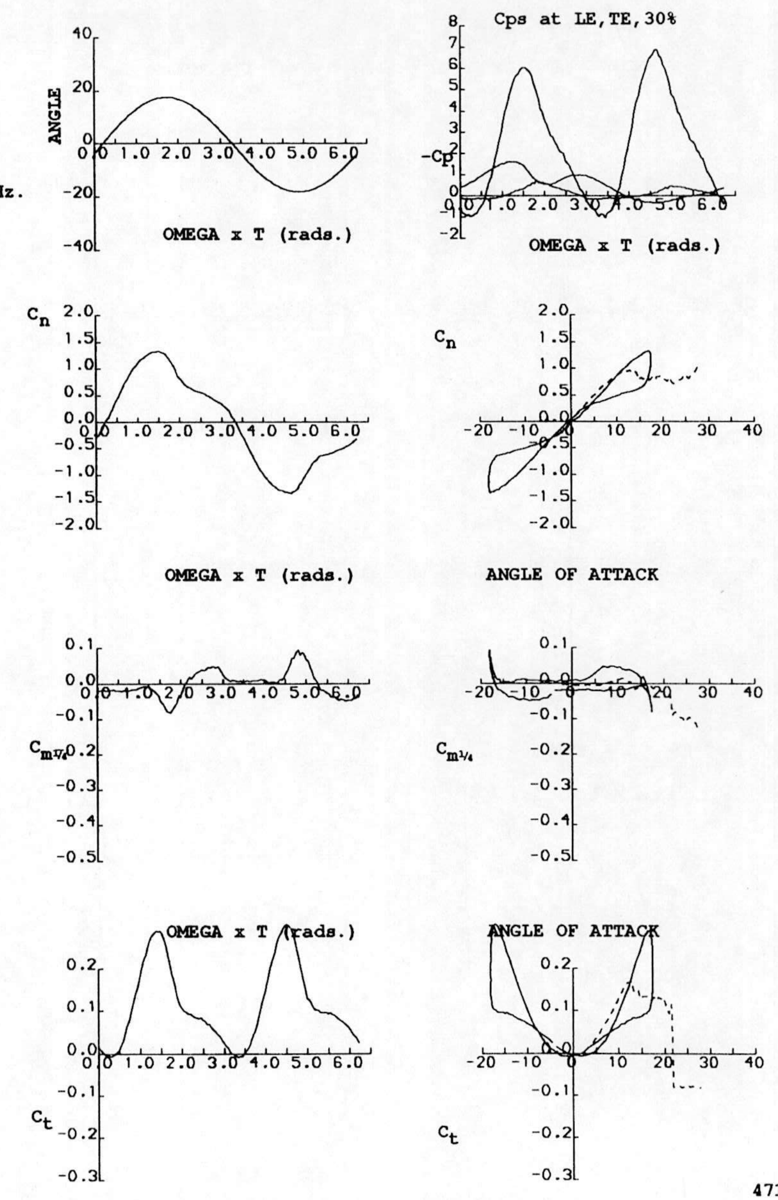




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14711	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1497468.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.39 Nm^{-2}	AIR TEMPERATURE = 18.7°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 156.03 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.053
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.219 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54781

REYNOLDS NUMBER = 1505466.

DYNAMIC PRESSURE = 986.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

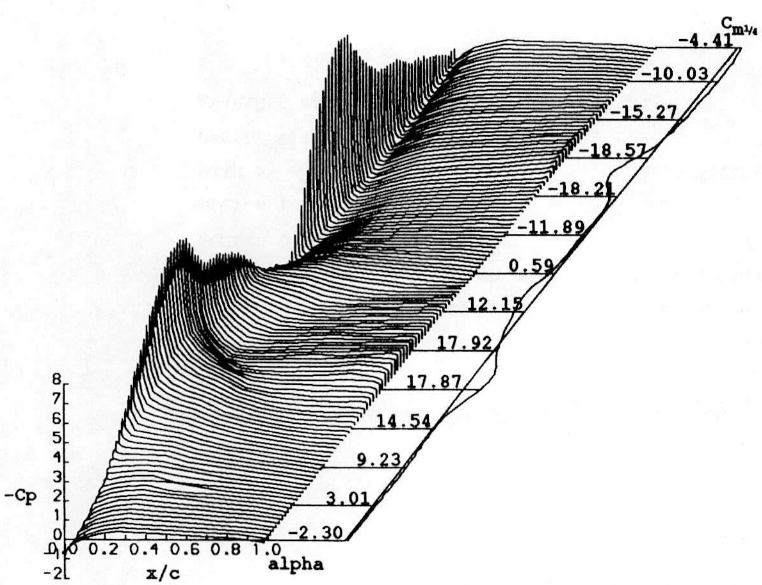
MACH NUMBER = 0.118

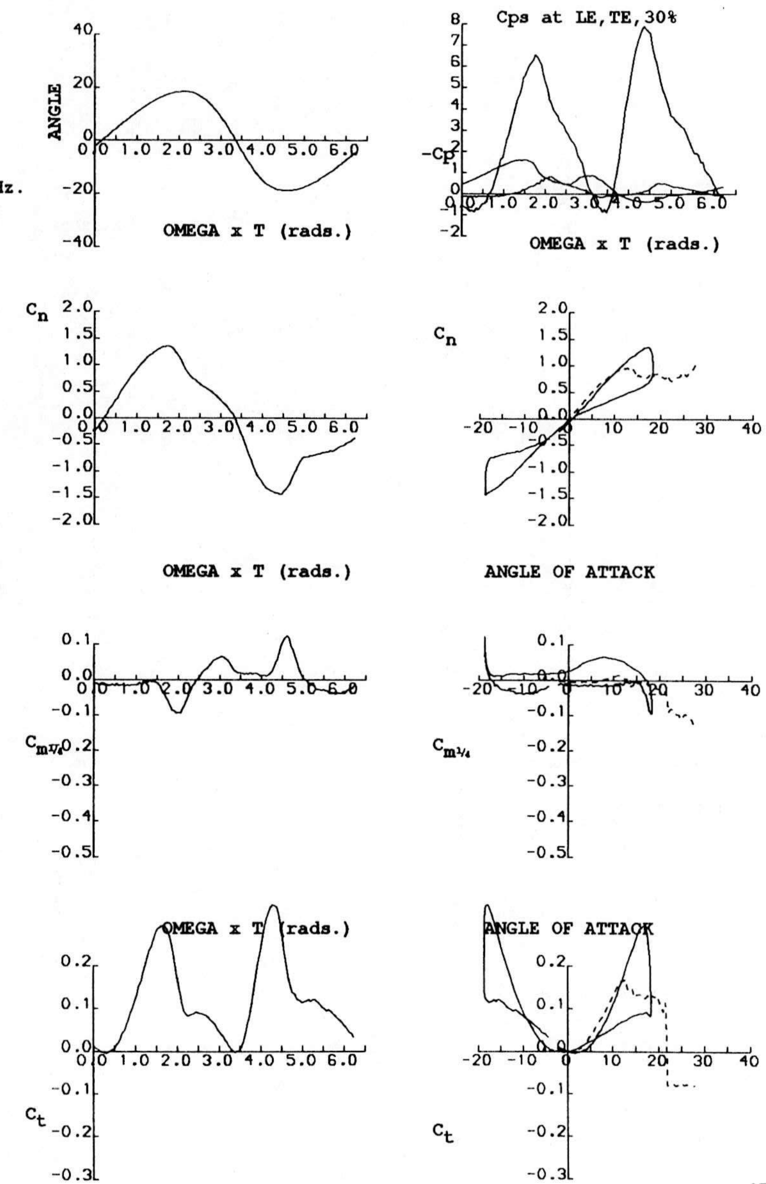
AIR TEMPERATURE = 19.7°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.052

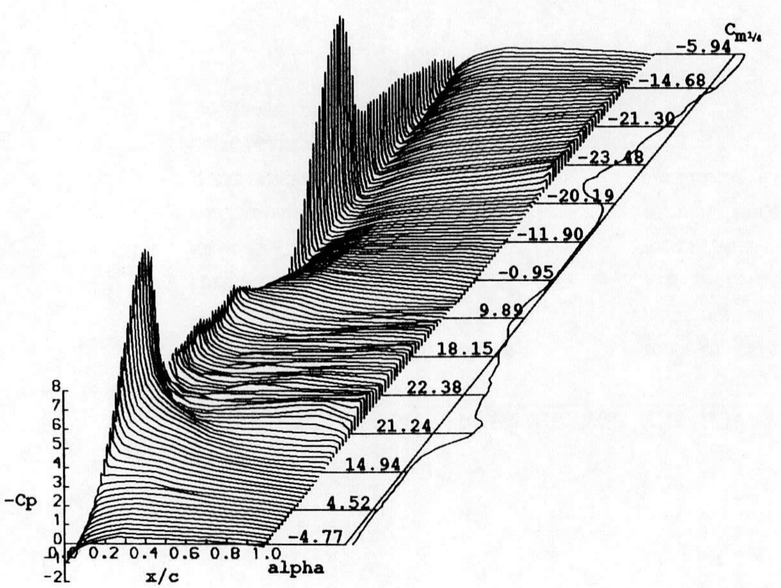
AMPLITUDE = 17.40°

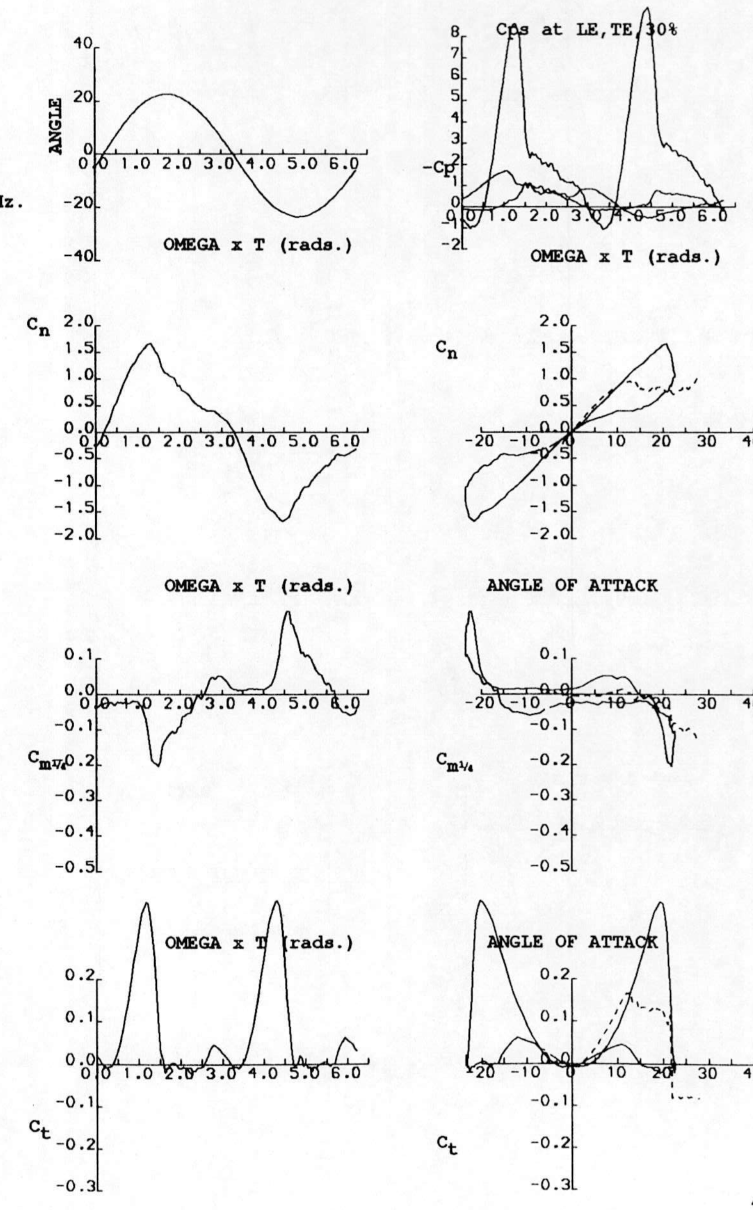




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14721	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1496150.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.39 Nm^{-2}	AIR TEMPERATURE = 18.9°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 156.03 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.053
MEAN ANGLE = 0.00°	AMPLITUDE = 22.60°
OSCILLATION FREQUENCY = 1.219 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54791

REYNOLDS NUMBER = 1502169.

DYNAMIC PRESSURE = 986.39 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.219 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

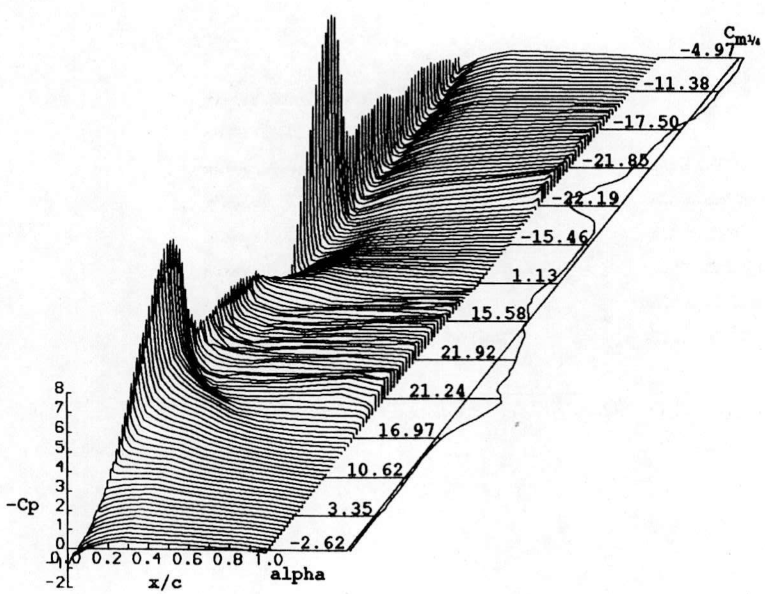
MACH NUMBER = 0.118

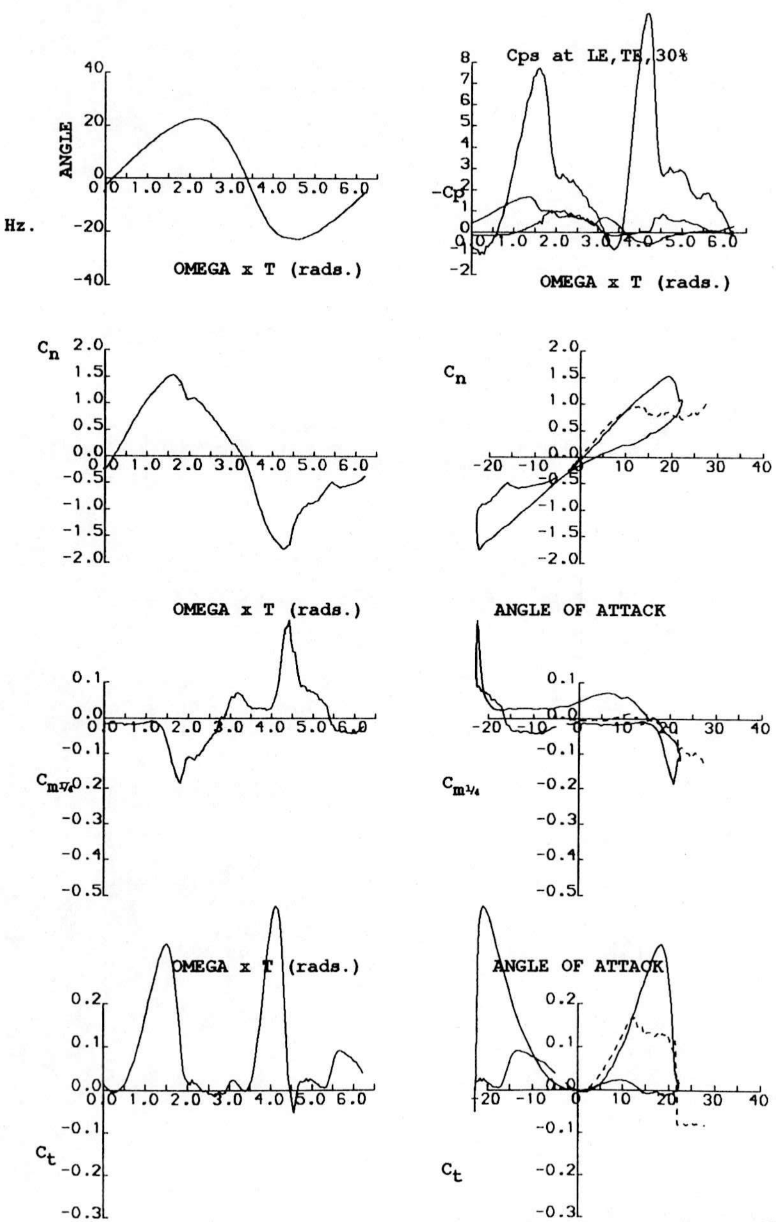
AIR TEMPERATURE = 20.2°C

SAMPLING FREQUENCY = 156.03 Hz.

REDUCED FREQUENCY = 0.052

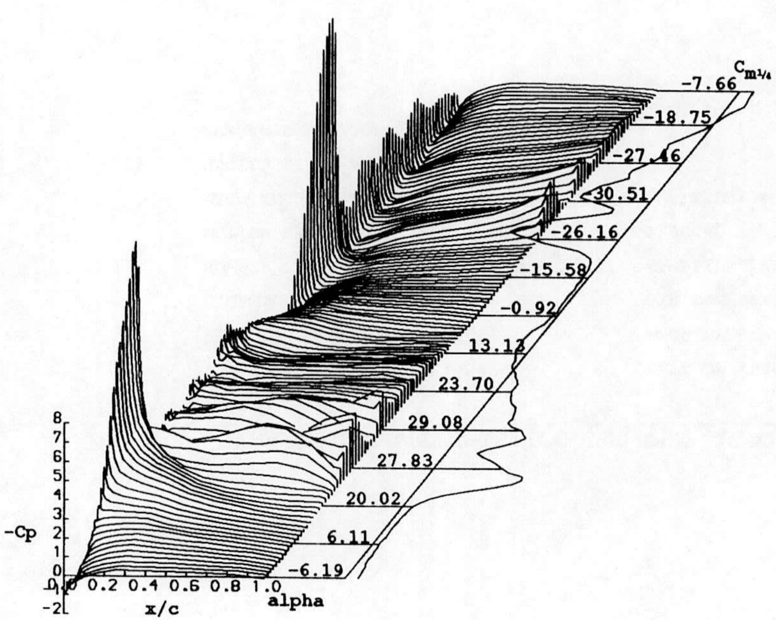
AMPLITUDE = 22.60°

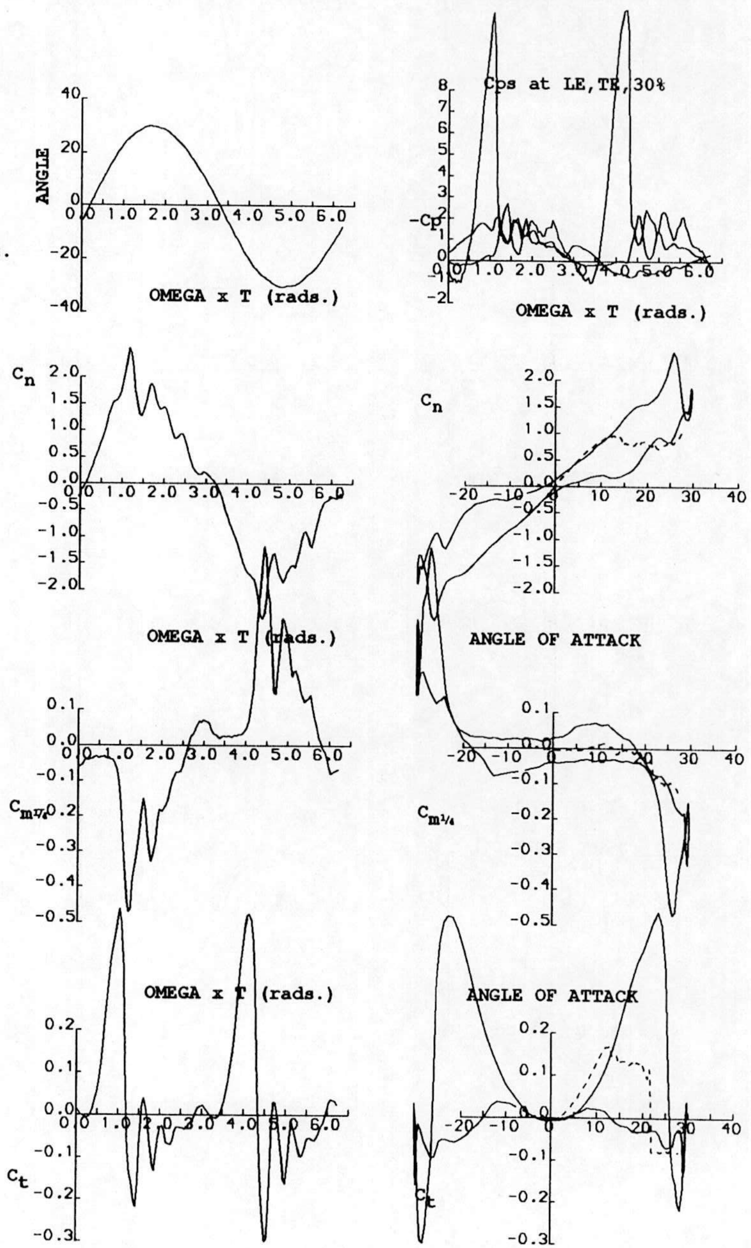




DYNAMIC CHARACTERISTICS FOR THE GUVA10

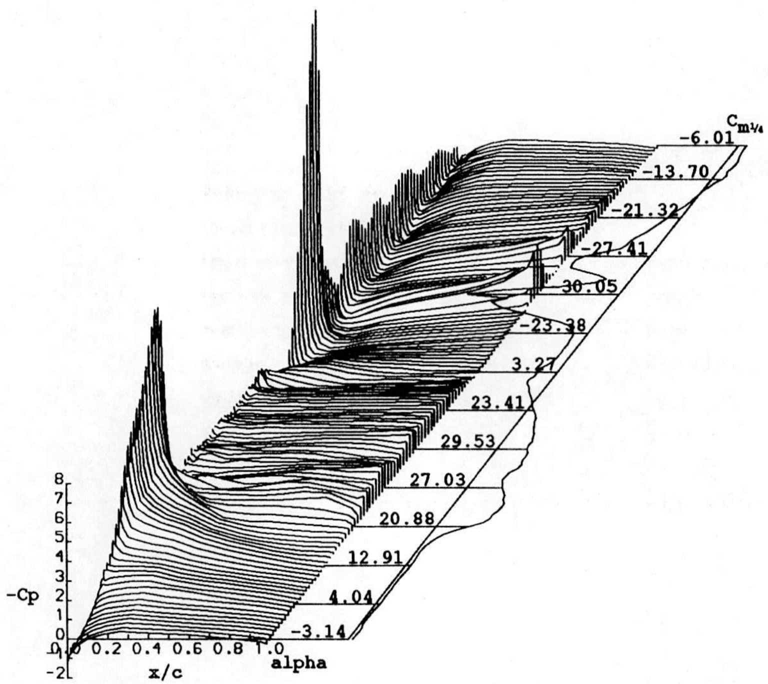
RUN REFERENCE NUMBER: 14731	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1494175.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.39 Nm^{-2}	AIR TEMPERATURE = 19.2°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 156.03 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.053
MEAN ANGLE = 0.00°	AMPLITUDE = 32.80°
OSCILLATION FREQUENCY = 1.219 Hz.	
AVERAGED DATA OF 10 CYCLES	

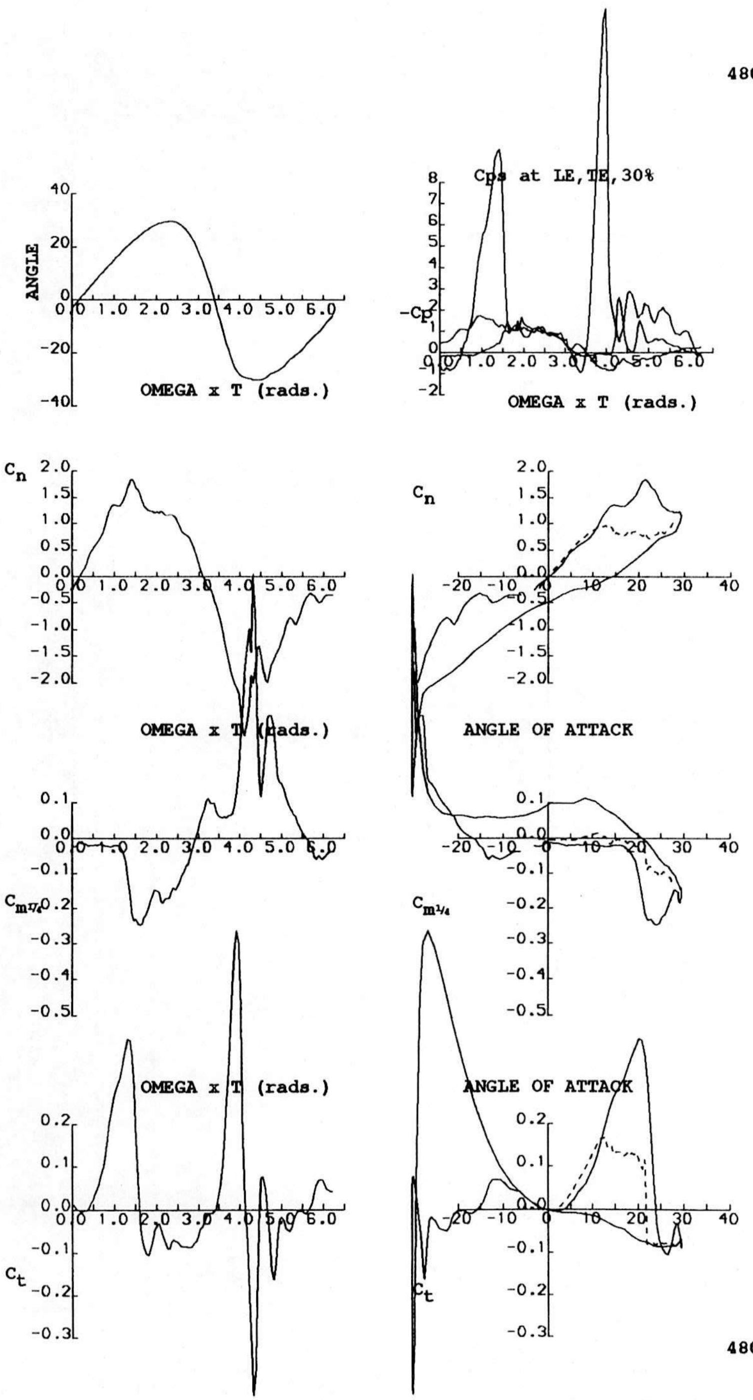




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54801	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1500854.	MACH NUMBER = 0.118
DYNAMIC PRESSURE = 986.39 Nm^{-2}	AIR TEMPERATURE = 20.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 156.03 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.052
MEAN ANGLE = 0.00°	AMPLITUDE = 30.00°
OSCILLATION FREQUENCY = 1.219 Hz.	
AVERAGED DATA OF 10 CYCLES	

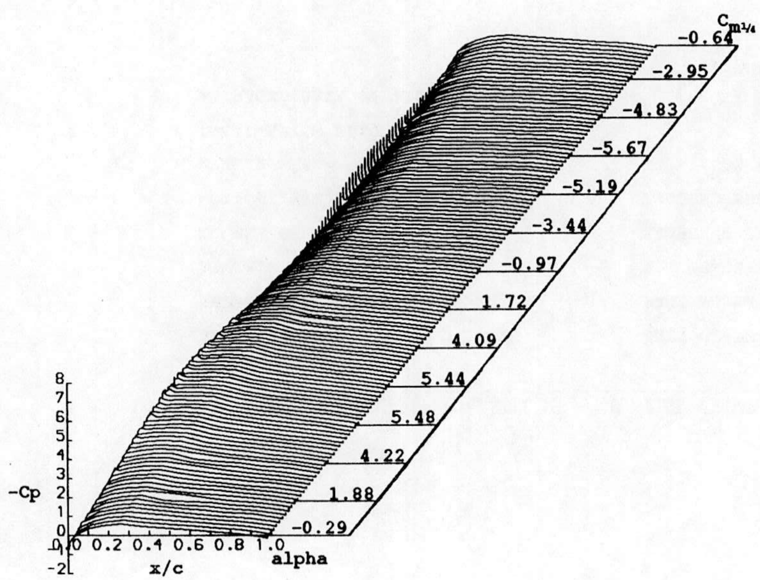


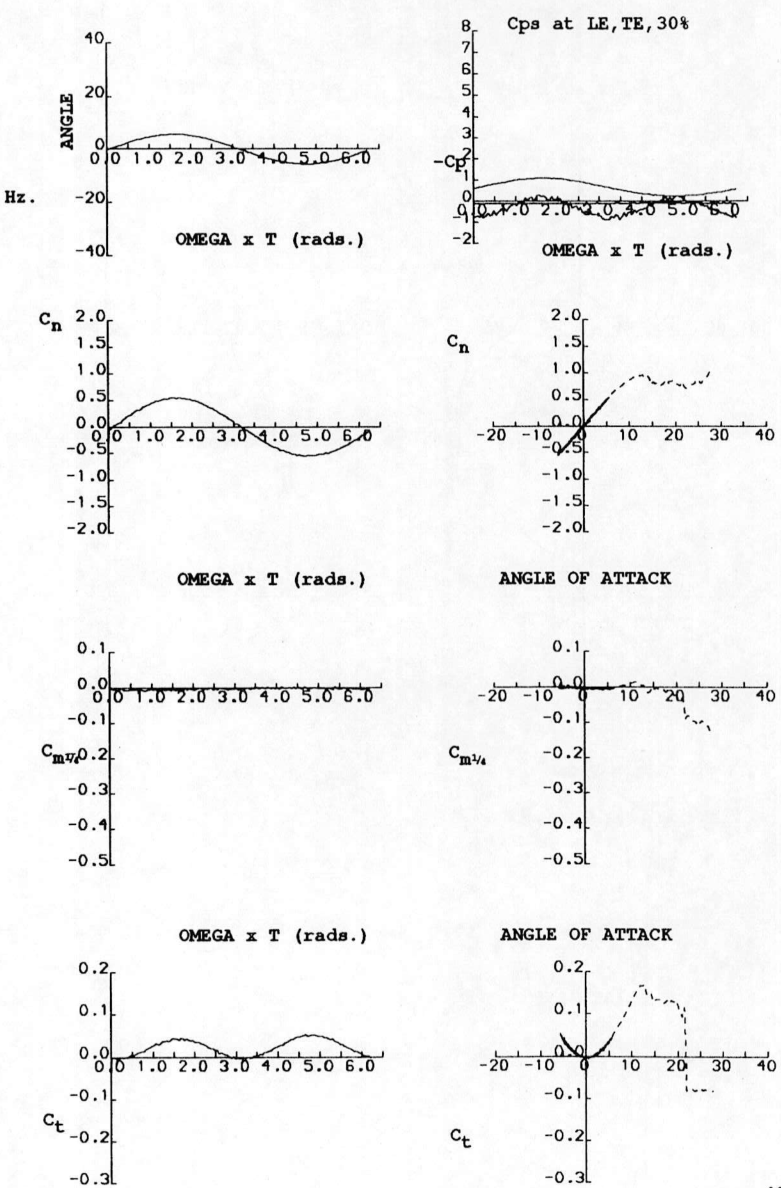


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14881
REYNOLDS NUMBER = 1484228.
DYNAMIC PRESSURE = 965.51 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.488 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 20.5°C
SAMPLING FREQUENCY = 62.46 Hz.
REDUCED FREQUENCY = 0.021
AMPLITUDE = 5.40°

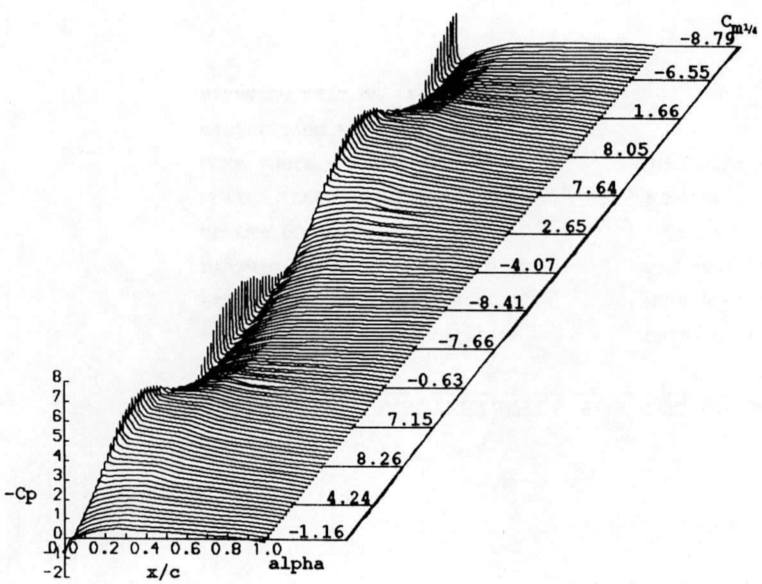


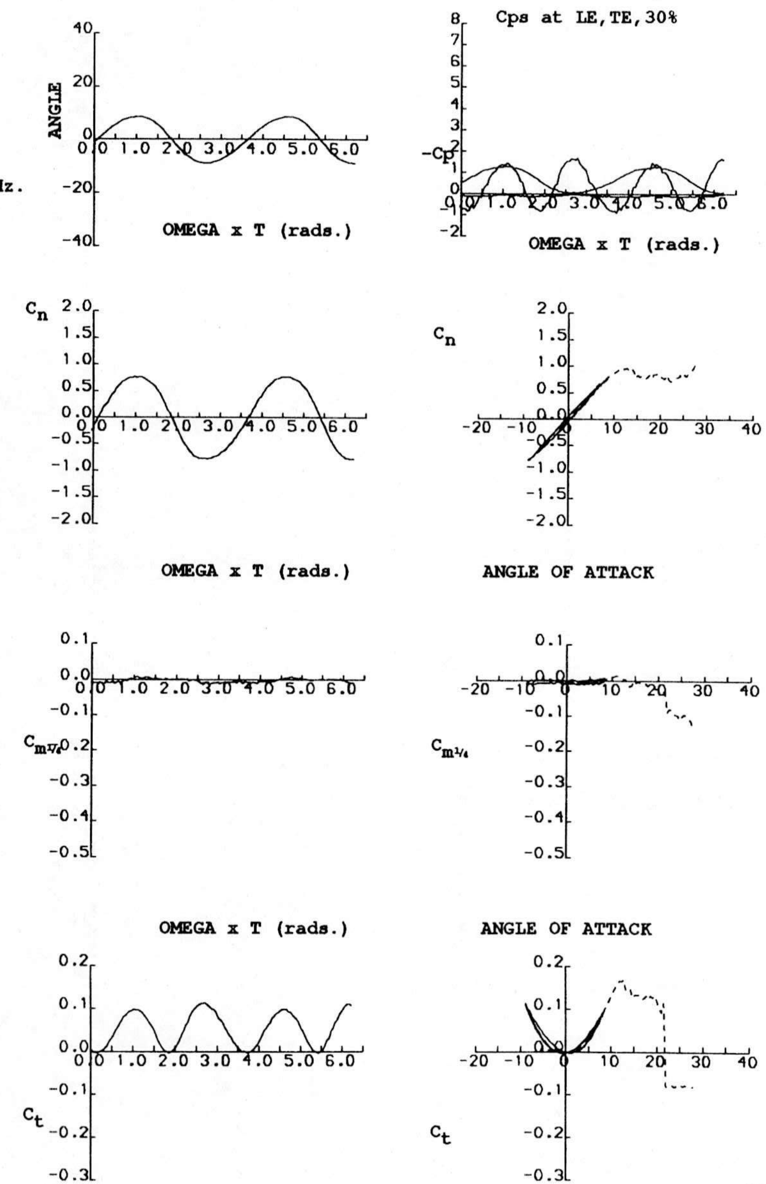


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54811
REYNOLDS NUMBER = 1498887.
DYNAMIC PRESSURE = 976.93 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.488 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 19.6°C
SAMPLING FREQUENCY = 62.46 Hz.
REDUCED FREQUENCY = 0.021
AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14891

DATE OF TEST: 5/3/92

REYNOLDS NUMBER = 1481635.

MACH NUMBER = 0.117

DYNAMIC PRESSURE = 965.51 Nm^{-2}

AIR TEMPERATURE = 20.9°C

NUMBER OF CYCLES = 10

SAMPLING FREQUENCY = 62.46 Hz.

MOTION TYPE: SINUSOIDAL

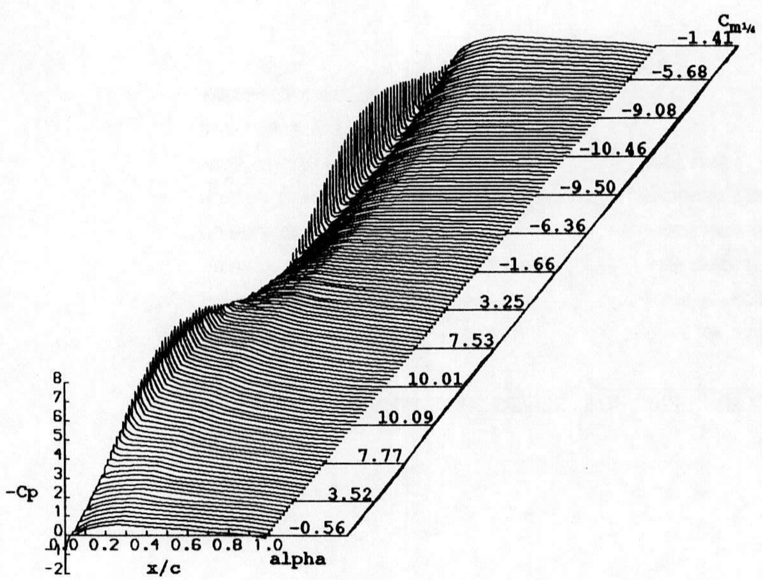
REDUCED FREQUENCY = 0.021

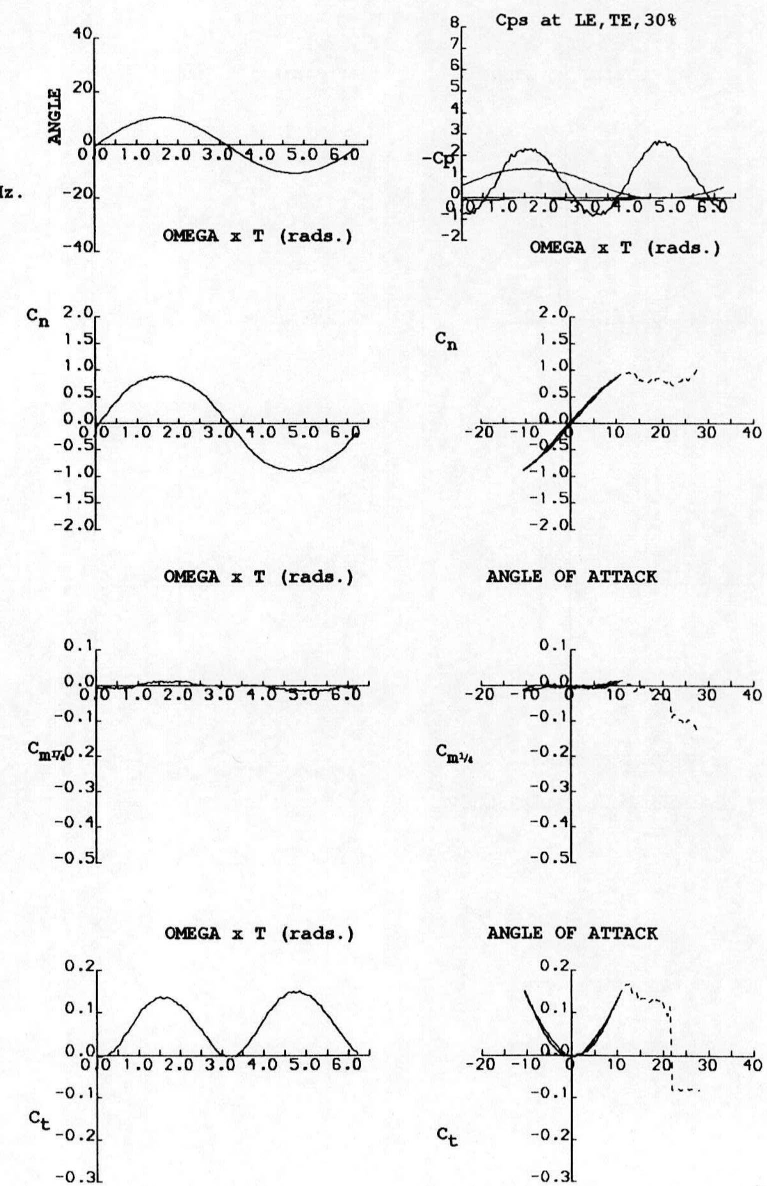
MEAN ANGLE = 0.00°

AMPLITUDE = 10.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54821

REYNOLDS NUMBER = 1497572.

DYNAMIC PRESSURE = 976.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

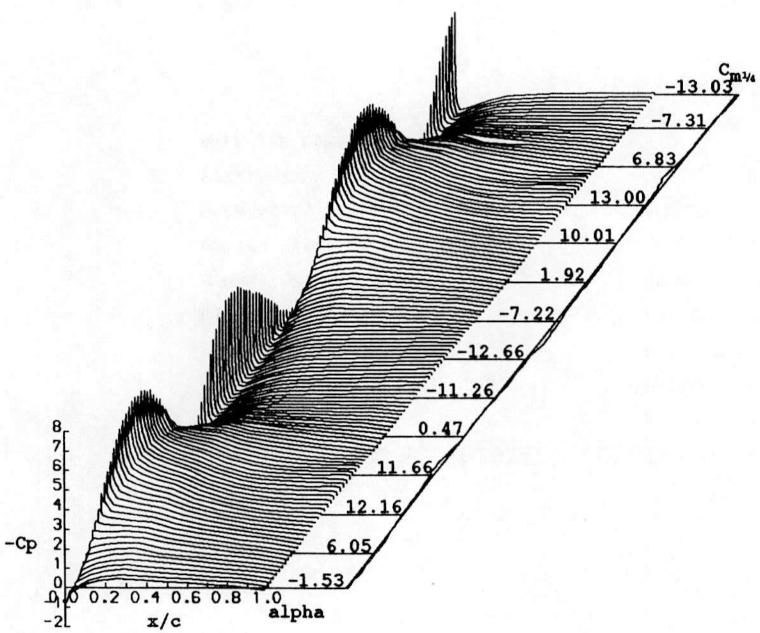
MACH NUMBER = 0.117

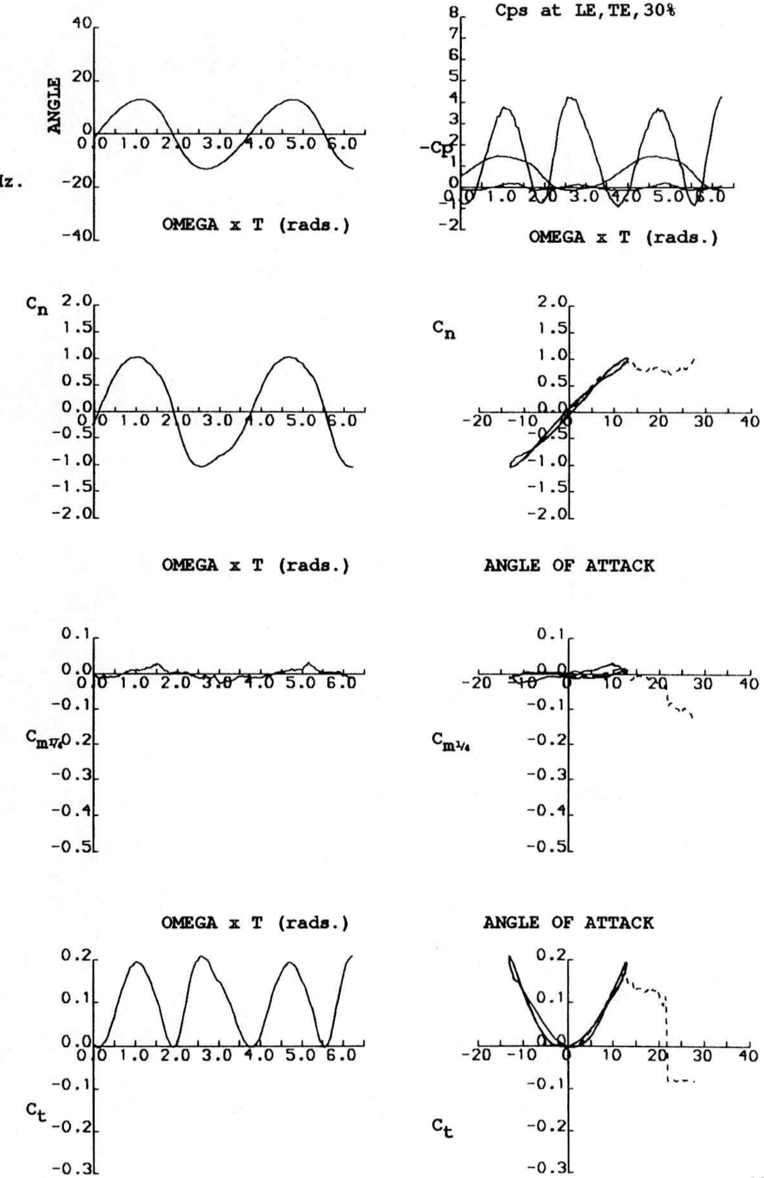
AIR TEMPERATURE = 19.8°C

SAMPLING FREQUENCY = 62.46 Hz.

REDUCED FREQUENCY = 0.021

AMPLITUDE = 10.00°





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DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14901

REYNOLDS NUMBER = 1480341.

DYNAMIC PRESSURE = 965.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

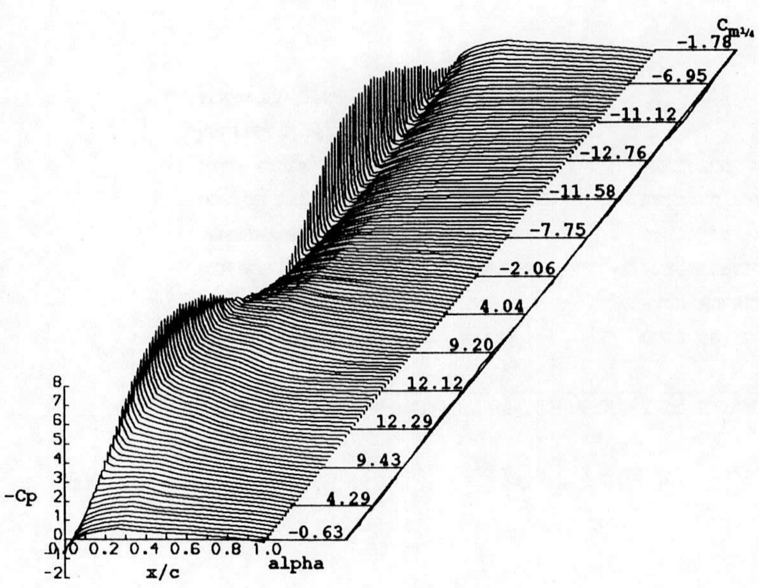
MACH NUMBER = 0.117

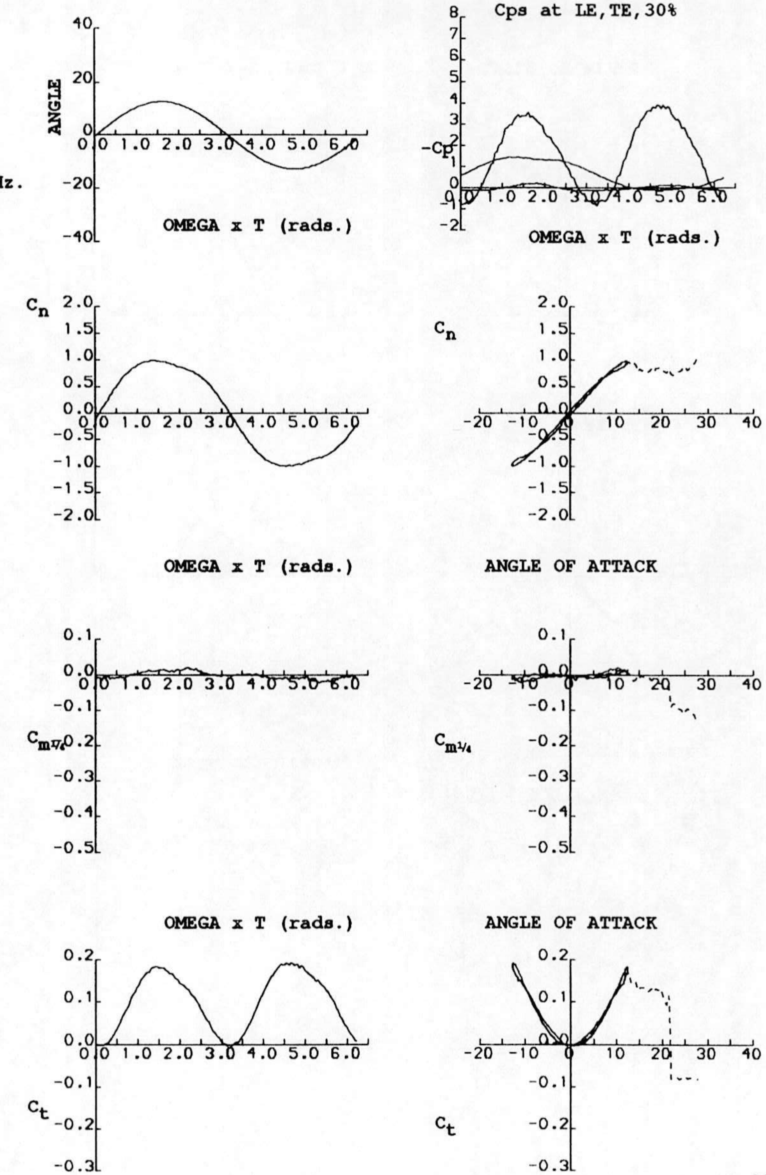
AIR TEMPERATURE = 21.1°C

SAMPLING FREQUENCY = 62.46 Hz.

REDUCED FREQUENCY = 0.021

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54831

REYNOLDS NUMBER = 1496259.

DYNAMIC PRESSURE = 976.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

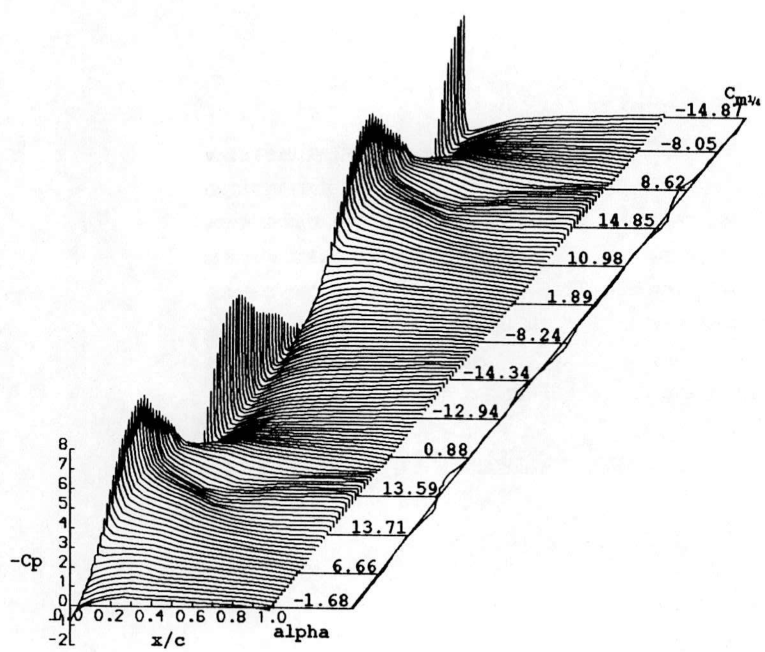
MACH NUMBER = 0.117

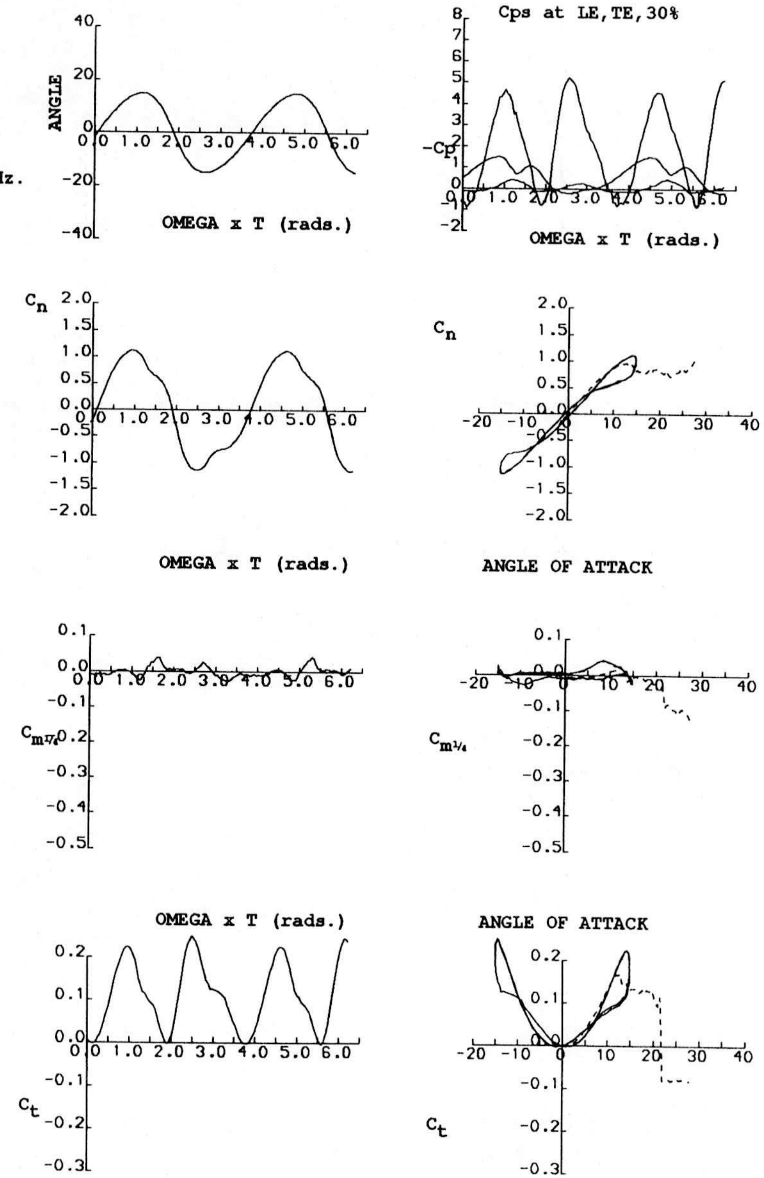
AIR TEMPERATURE = 20.0°C

SAMPLING FREQUENCY = 62.46 Hz.

REDUCED FREQUENCY = 0.021

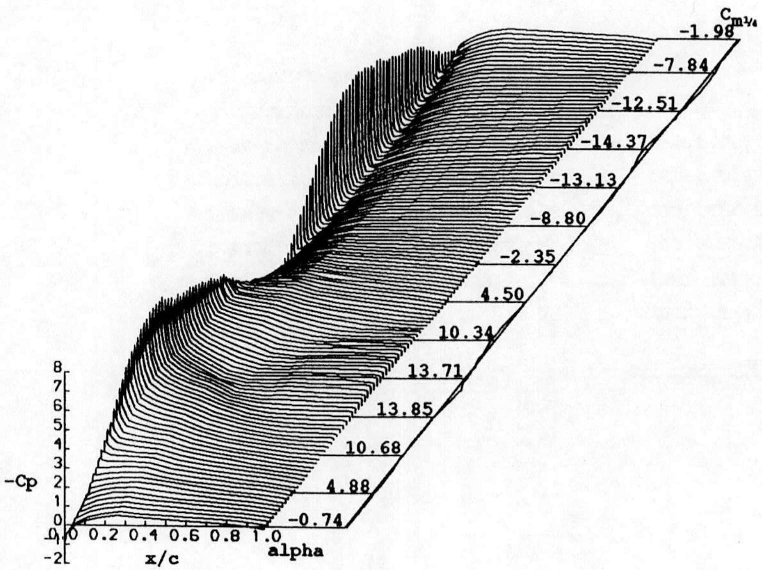
AMPLITUDE = 12.20°

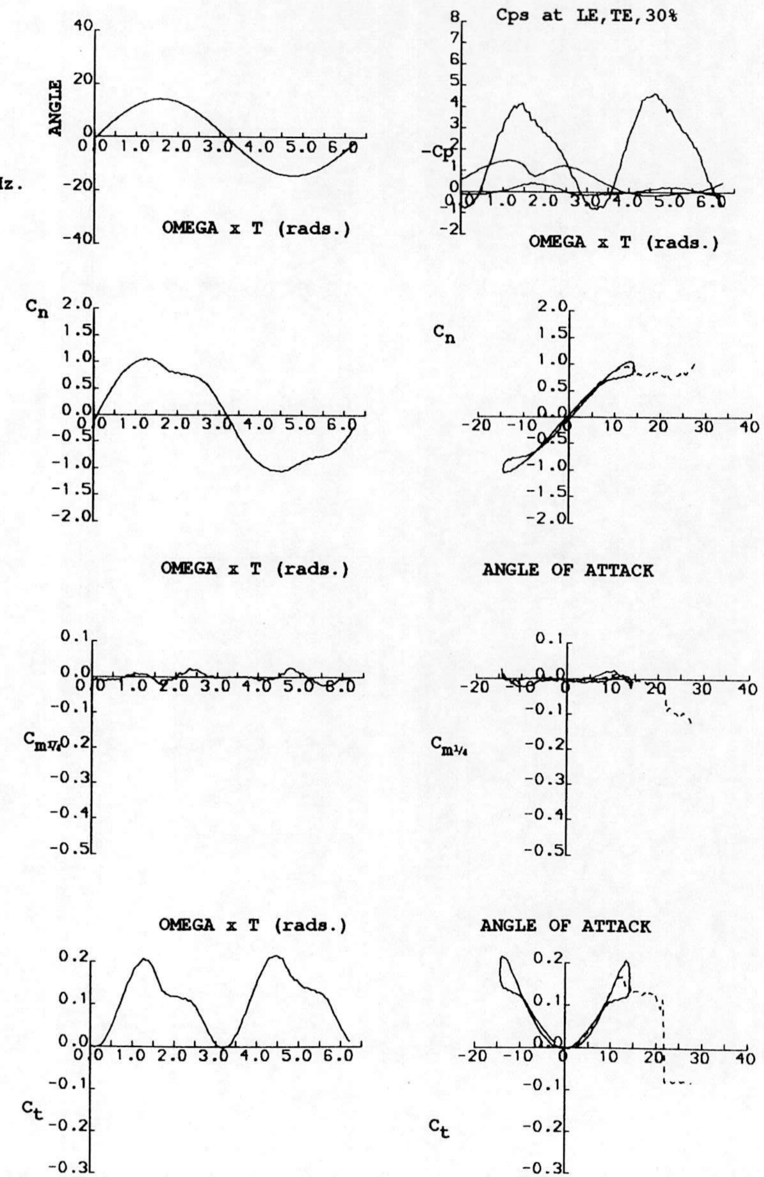




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14911	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1479050.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 965.51 Nm^{-2}	AIR TEMPERATURE = 21.3°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 62.46 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.021
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 0.488 Hz.	
AVERAGED DATA OF 10 CYCLES	

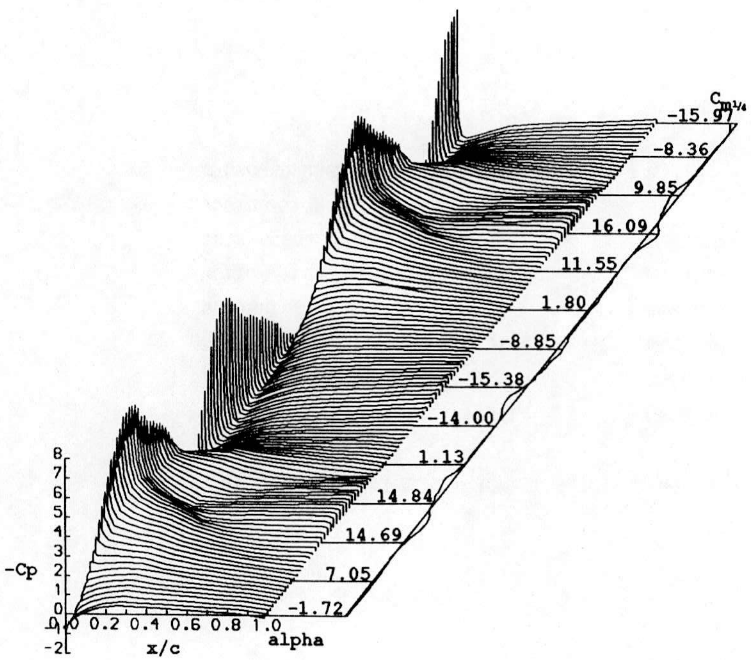


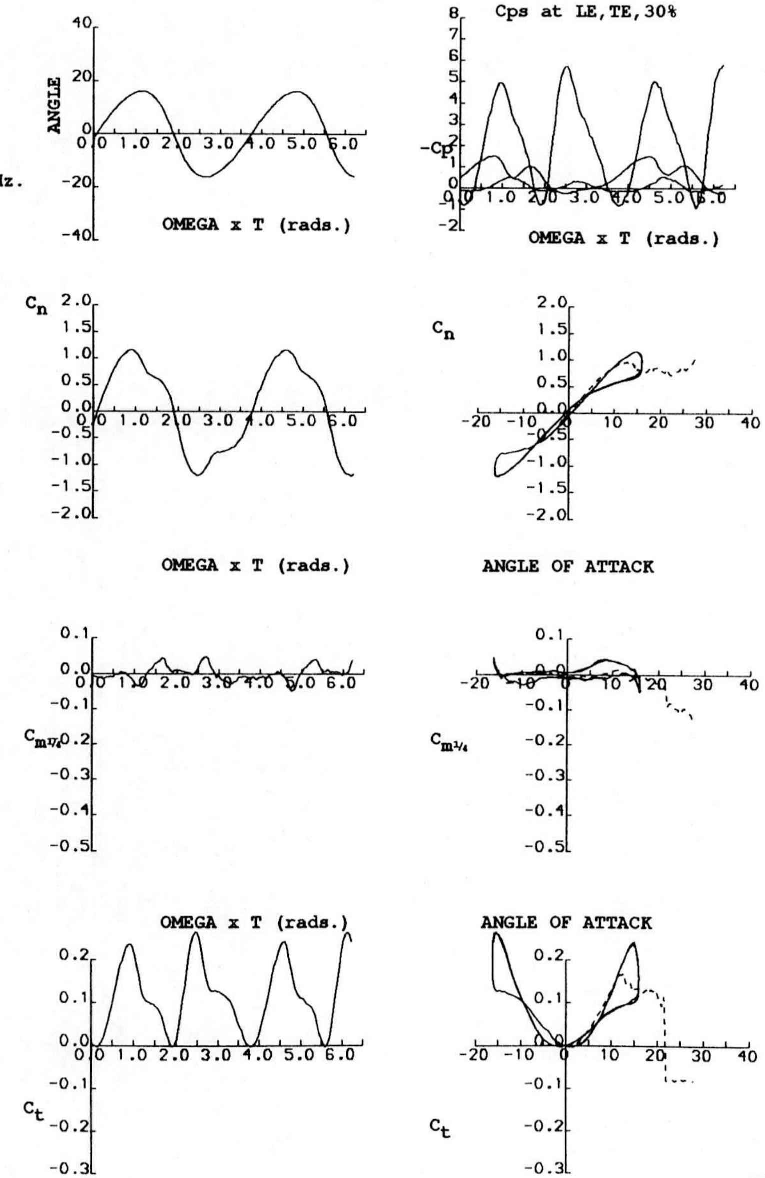


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54841
REYNOLDS NUMBER = 1494293.
DYNAMIC PRESSURE = 976.93 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.488 Hz.
AVERAGED DATA OF 10 CYCLES

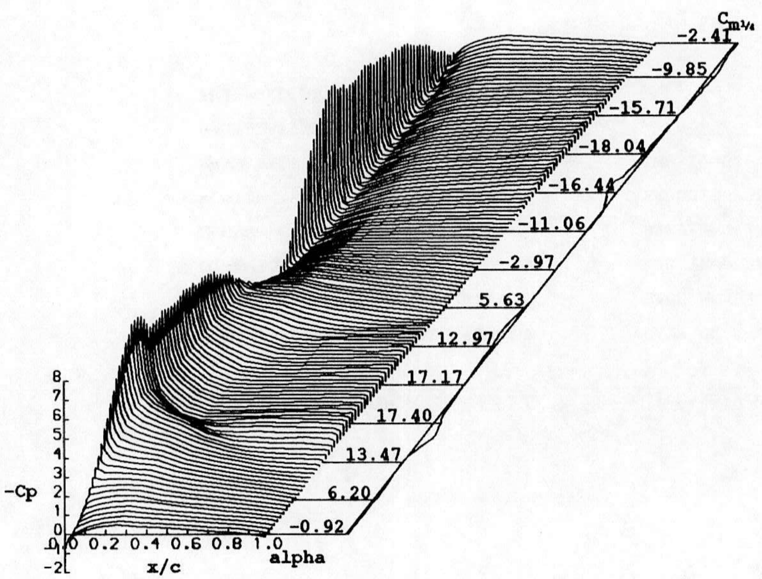
DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 20.3°C
SAMPLING FREQUENCY = 62.46 Hz.
REDUCED FREQUENCY = 0.021
AMPLITUDE = 13.80°

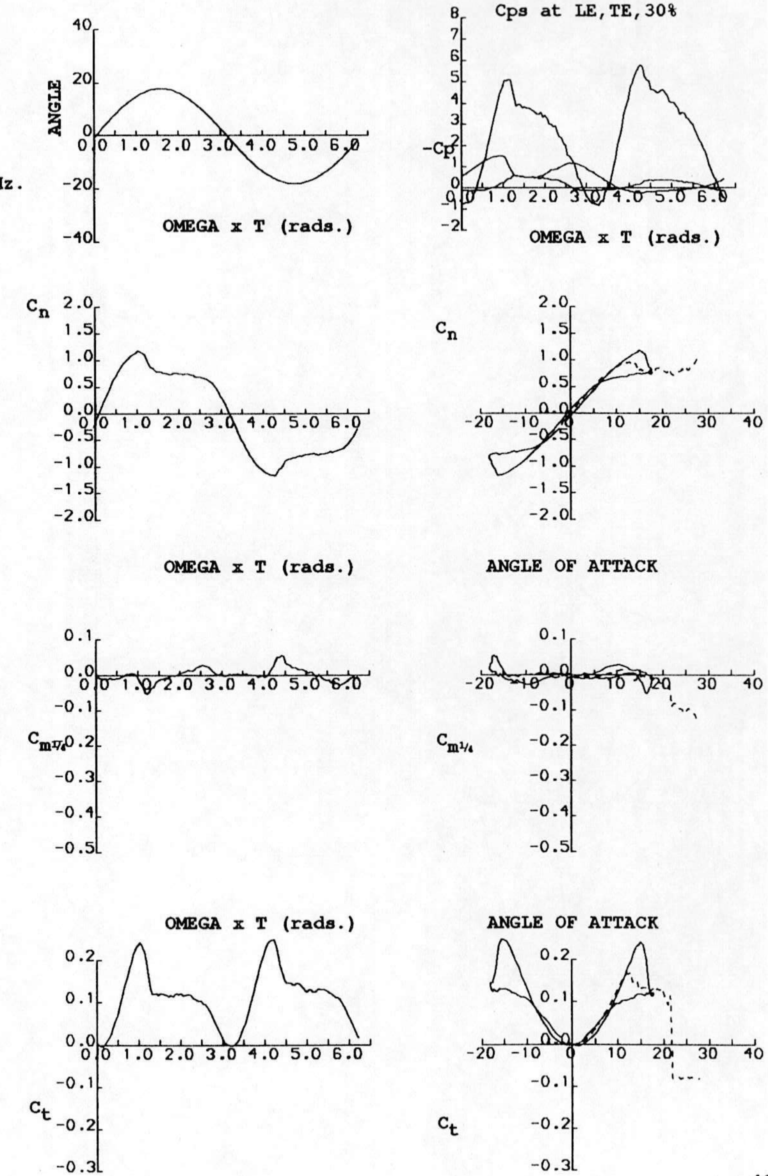




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14921	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1477117.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 965.51 Nm^{-2}	AIR TEMPERATURE = 21.6°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 62.46 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.021
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 0.488 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54851

REYNOLDS NUMBER = 1492985.

DYNAMIC PRESSURE = 976.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

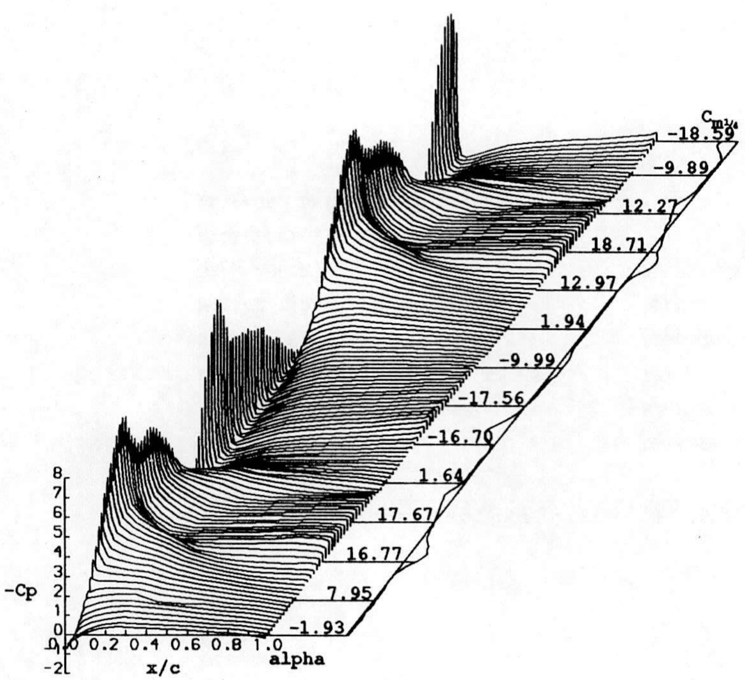
MACH NUMBER = 0.117

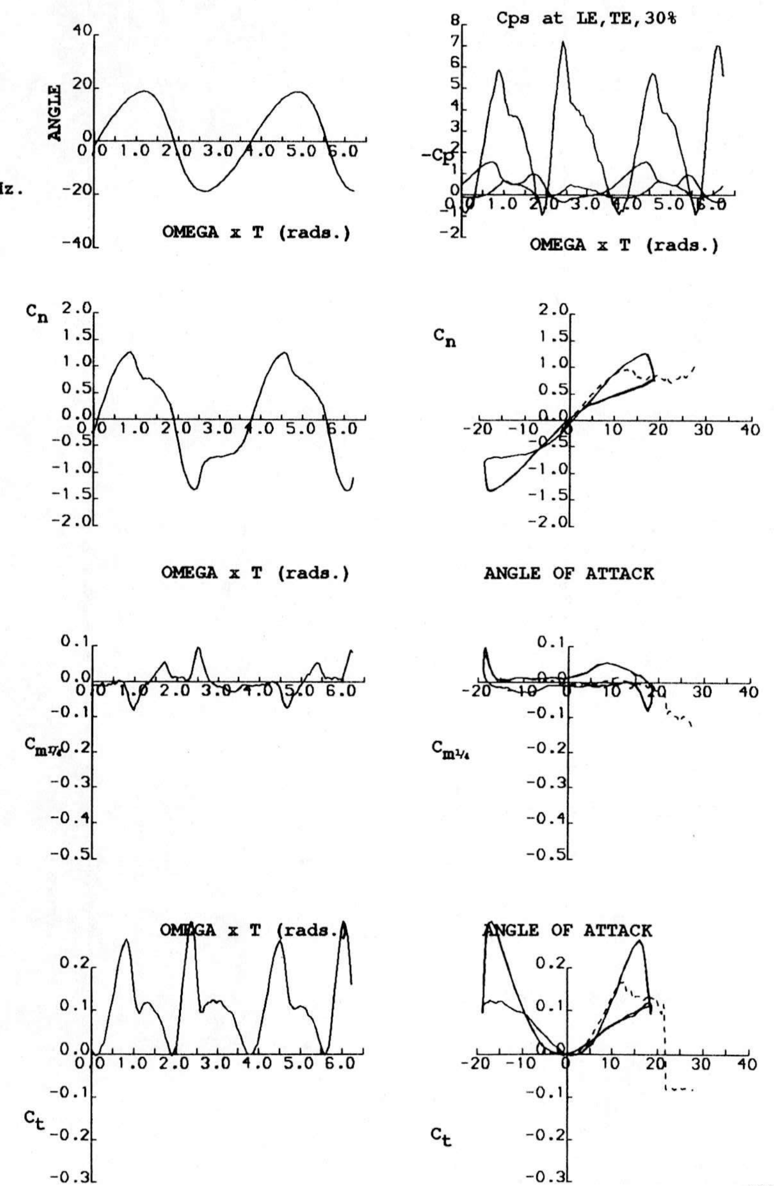
AIR TEMPERATURE = 20.5°C

SAMPLING FREQUENCY = 62.46 Hz.

REDUCED FREQUENCY = 0.021

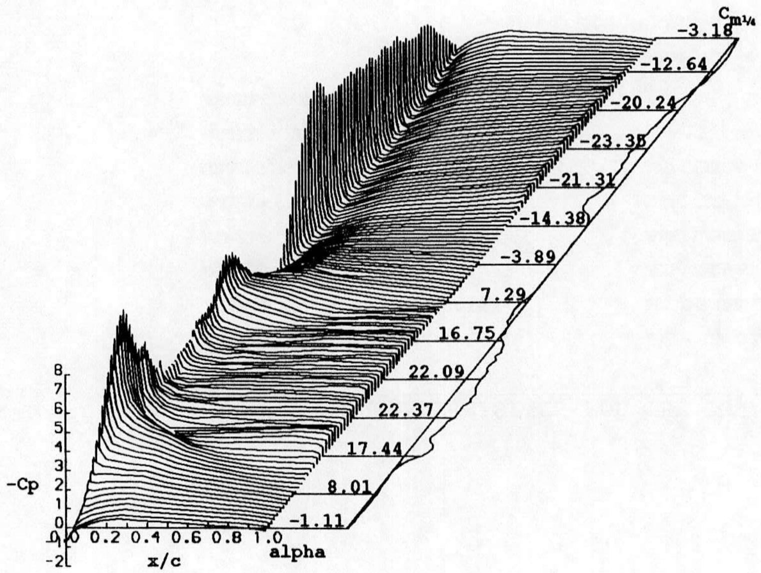
AMPLITUDE = 17.40°

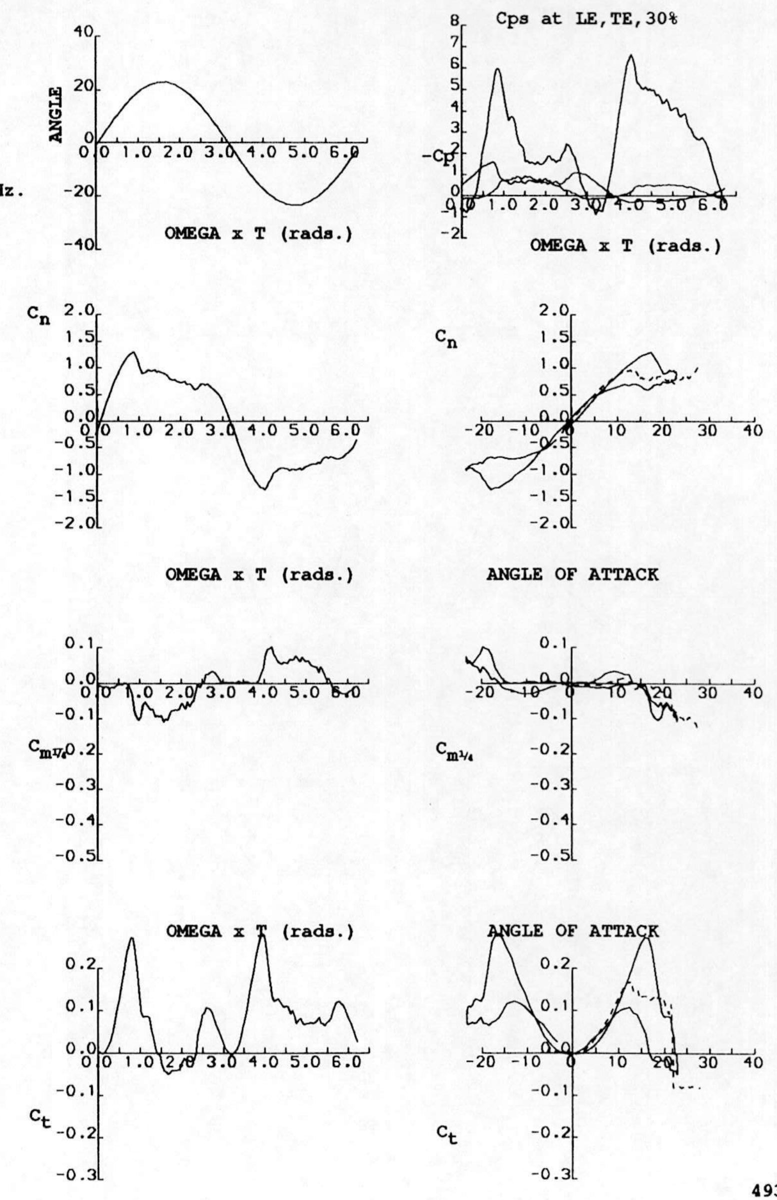




DYNAMIC CHARACTERISTICS FOR THE GUVA10

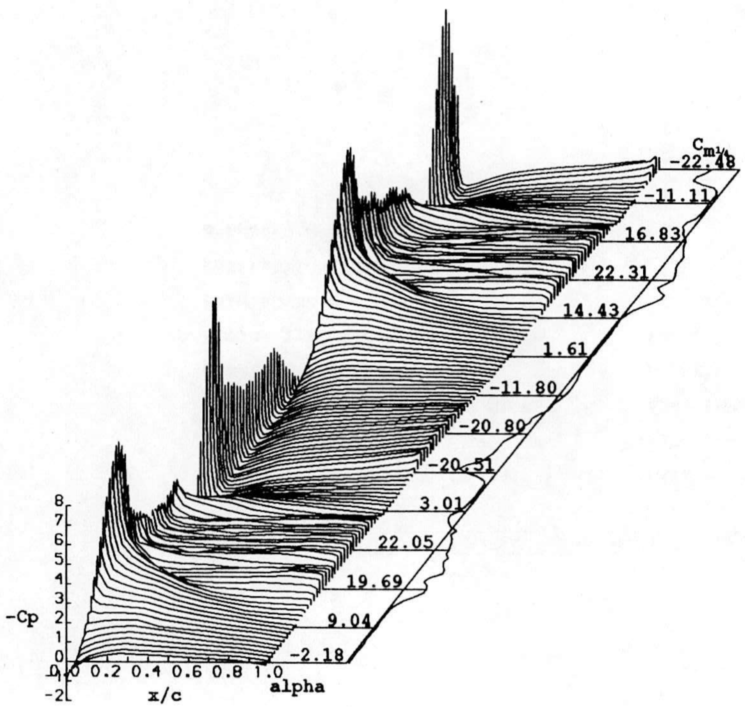
RUN REFERENCE NUMBER: 14931	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1475831.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 965.51 Nm^{-2}	AIR TEMPERATURE = 21.8°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 62.46 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.021
MEAN ANGLE = 0.00°	AMPLITUDE = 22.60°
OSCILLATION FREQUENCY = 0.488 Hz.	
AVERAGED DATA OF 10 CYCLES	

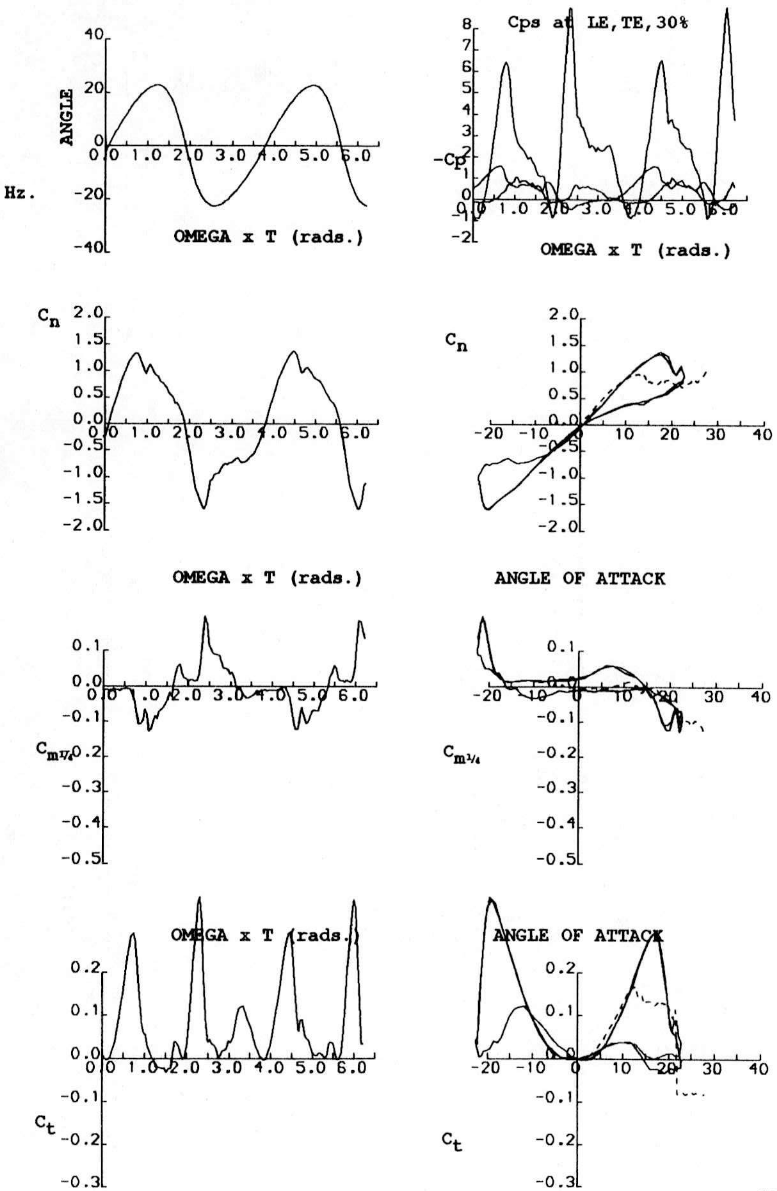




DYNAMIC CHARACTERISTICS FOR THE GUVA10

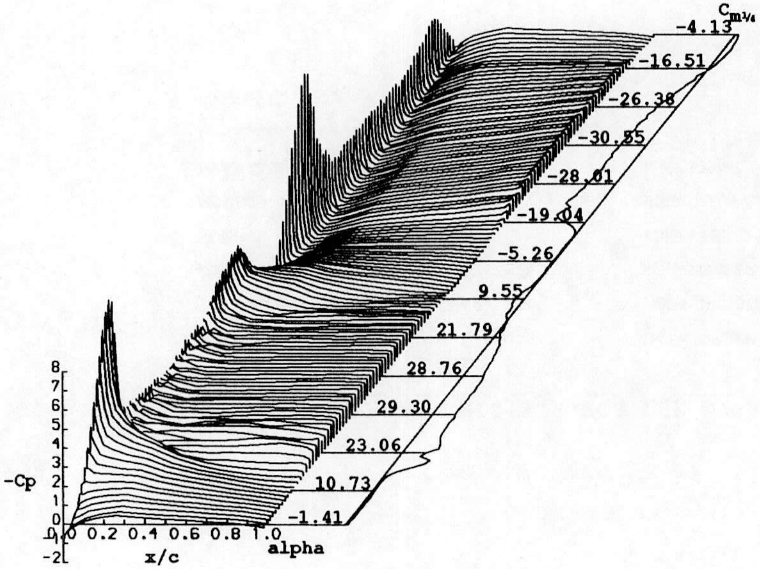
RUN REFERENCE NUMBER: 54861	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1491680.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 976.93 Nm^{-2}	AIR TEMPERATURE = 20.7°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 62.46 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.021
MEAN ANGLE = 0.00°	AMPLITUDE = 22.60°
OSCILLATION FREQUENCY = 0.488 Hz.	
AVERAGED DATA OF 10 CYCLES	

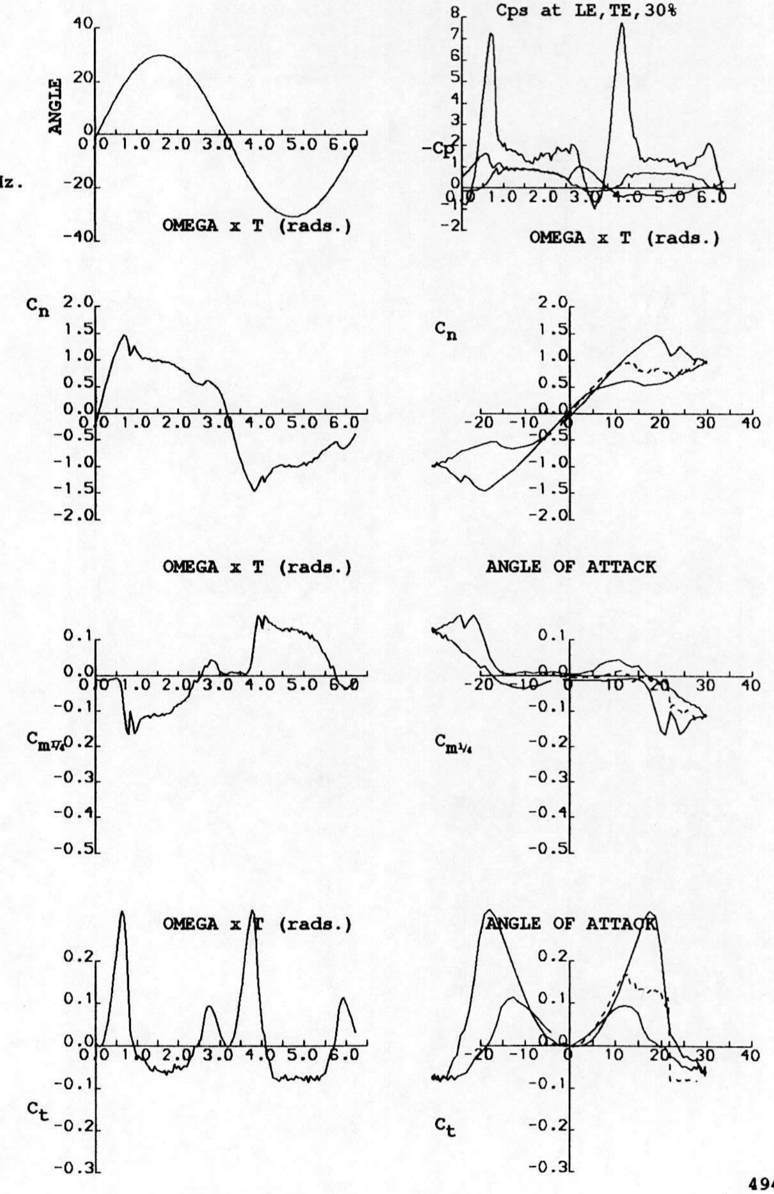




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14941	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1474547.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 965.51 Nm^{-2}	AIR TEMPERATURE = 22.0°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 62.46 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.021
MEAN ANGLE = 0.00°	AMPLITUDE = 30.00°
OSCILLATION FREQUENCY = 0.488 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 54871

REYNOLDS NUMBER = 1491028.

DYNAMIC PRESSURE = 976.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.488 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

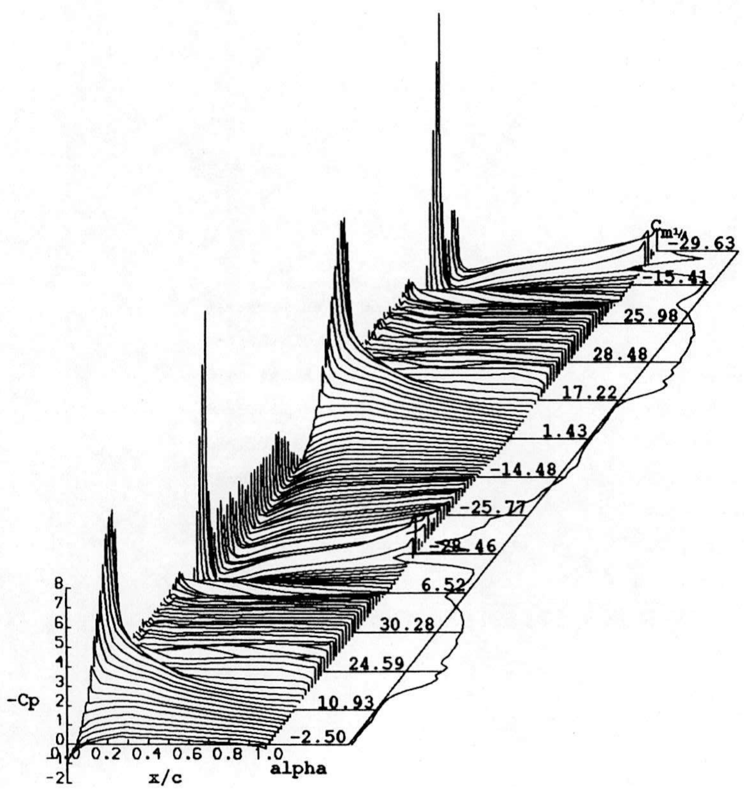
MACH NUMBER = 0.117

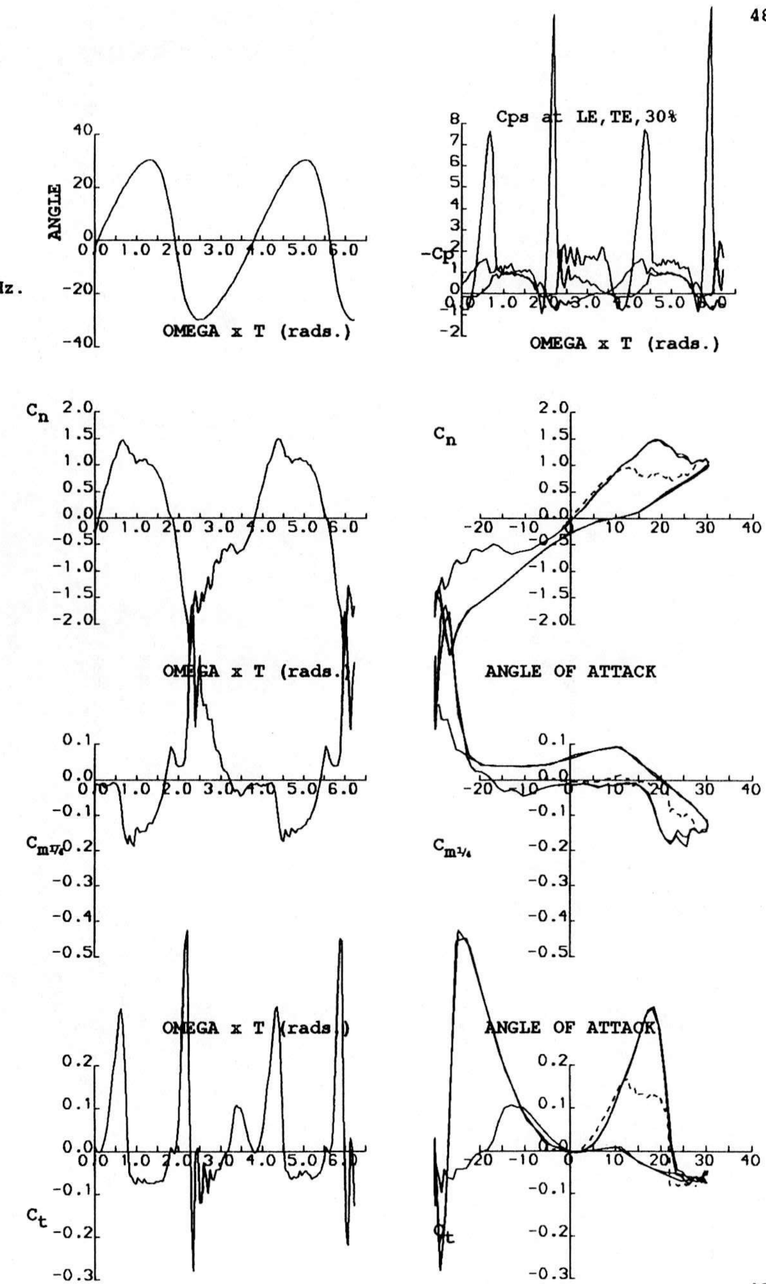
AIR TEMPERATURE = 20.8°C

SAMPLING FREQUENCY = 62.46 Hz.

REDUCED FREQUENCY = 0.021

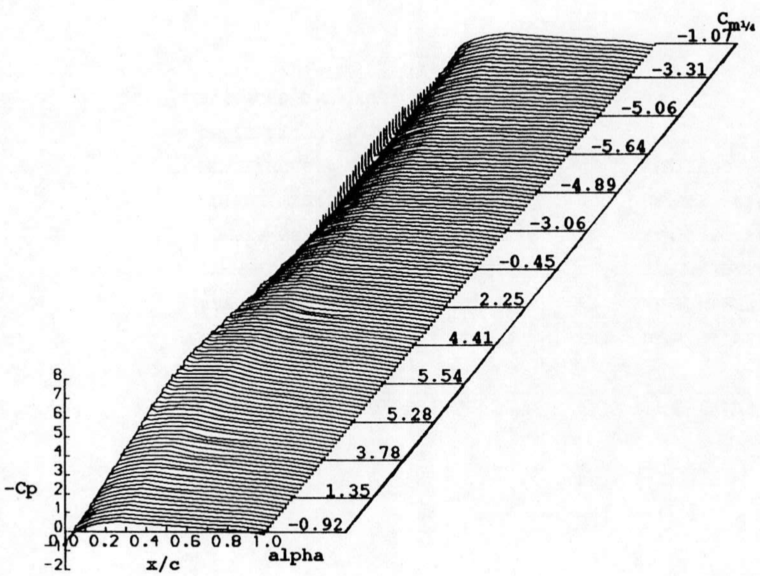
AMPLITUDE = 30.00°

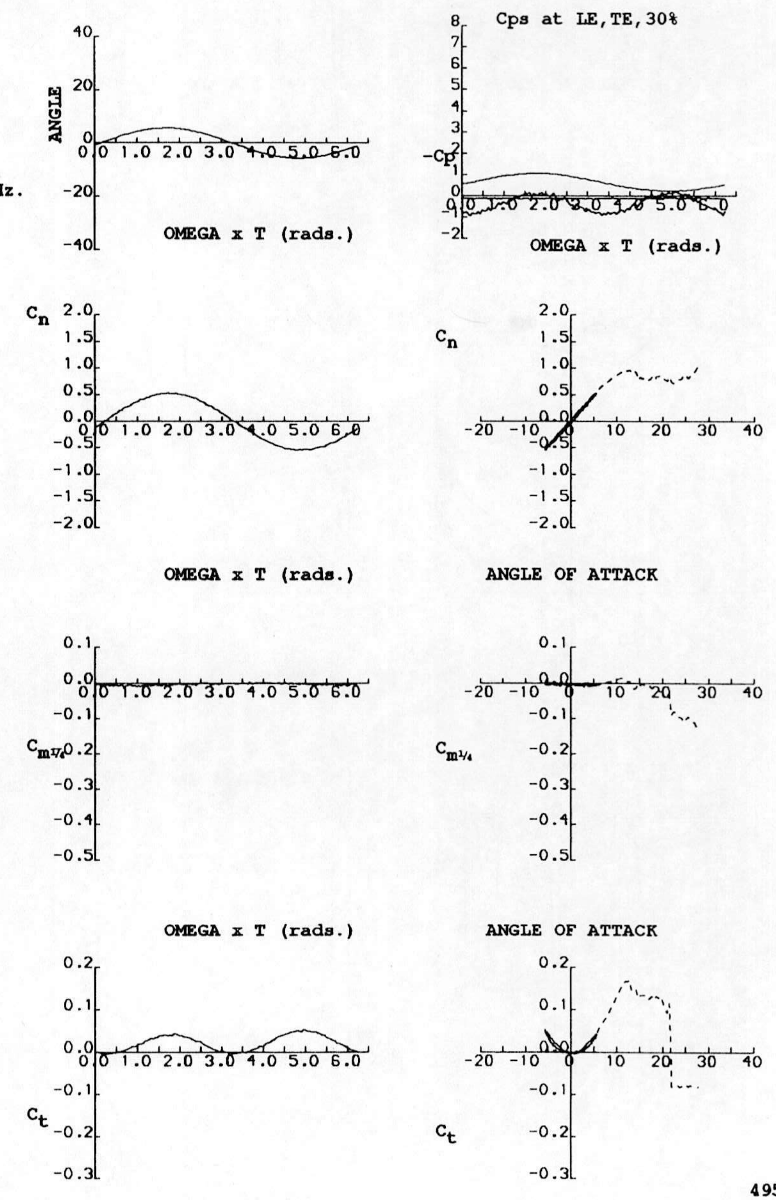




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14951	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1477867.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 963.96 Nm^{-2}	AIR TEMPERATURE = 21.3°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.042
MEAN ANGLE = 0.00°	AMPLITUDE = 5.40°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55021

REYNOLDS NUMBER = 1491822.

DYNAMIC PRESSURE = 976.71 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

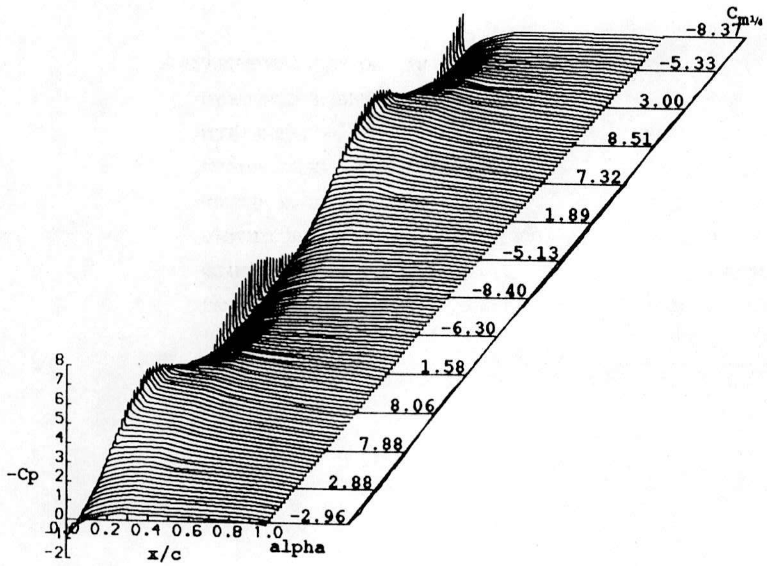
MACH NUMBER = 0.118

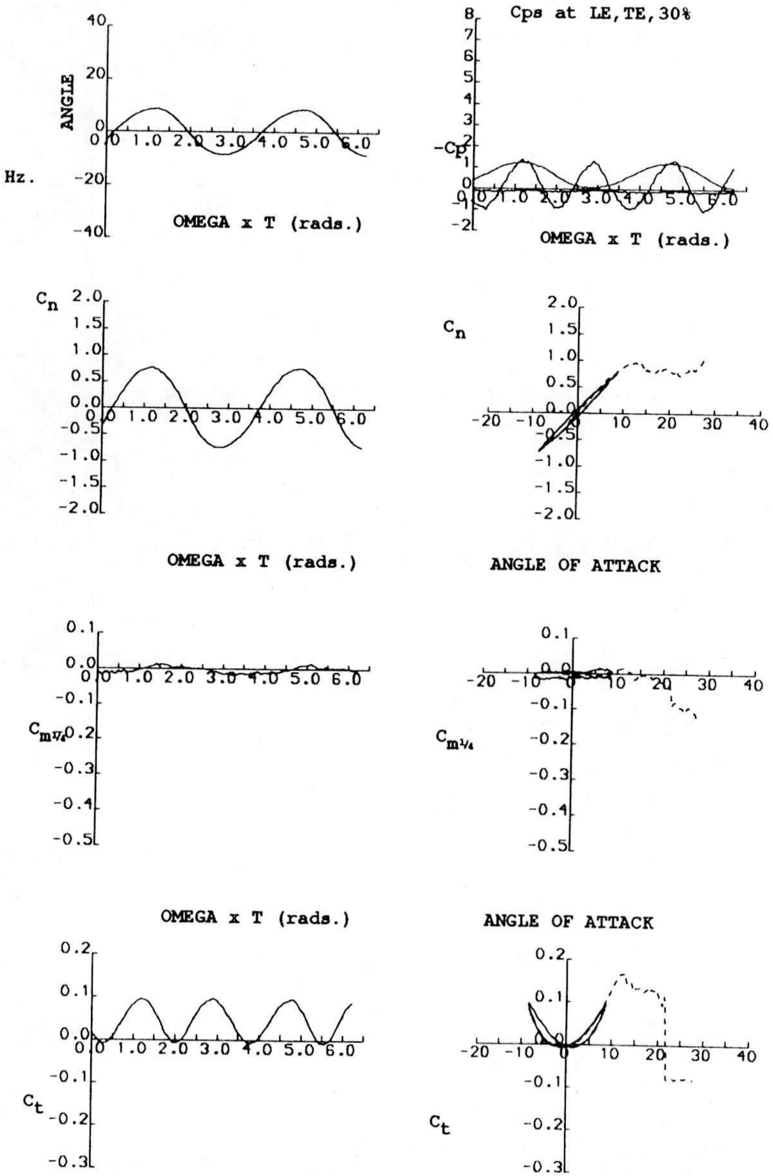
AIR TEMPERATURE = 20.2°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.042

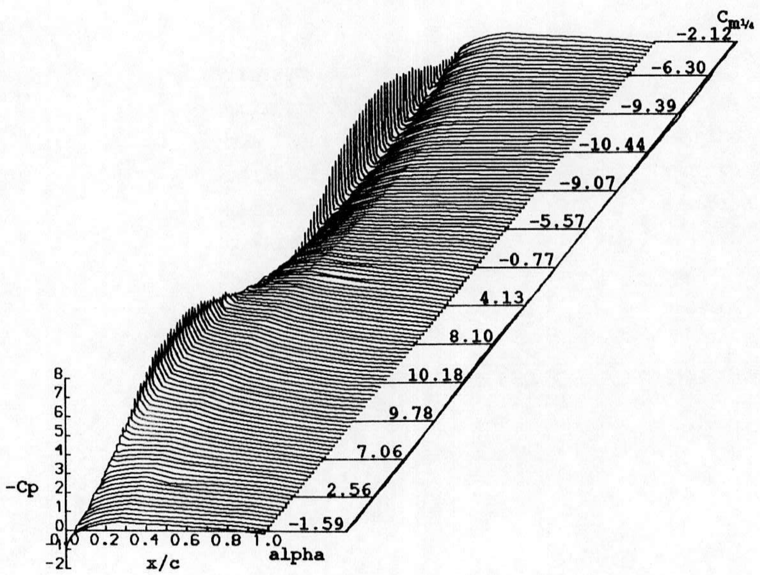
AMPLITUDE = 5.40°

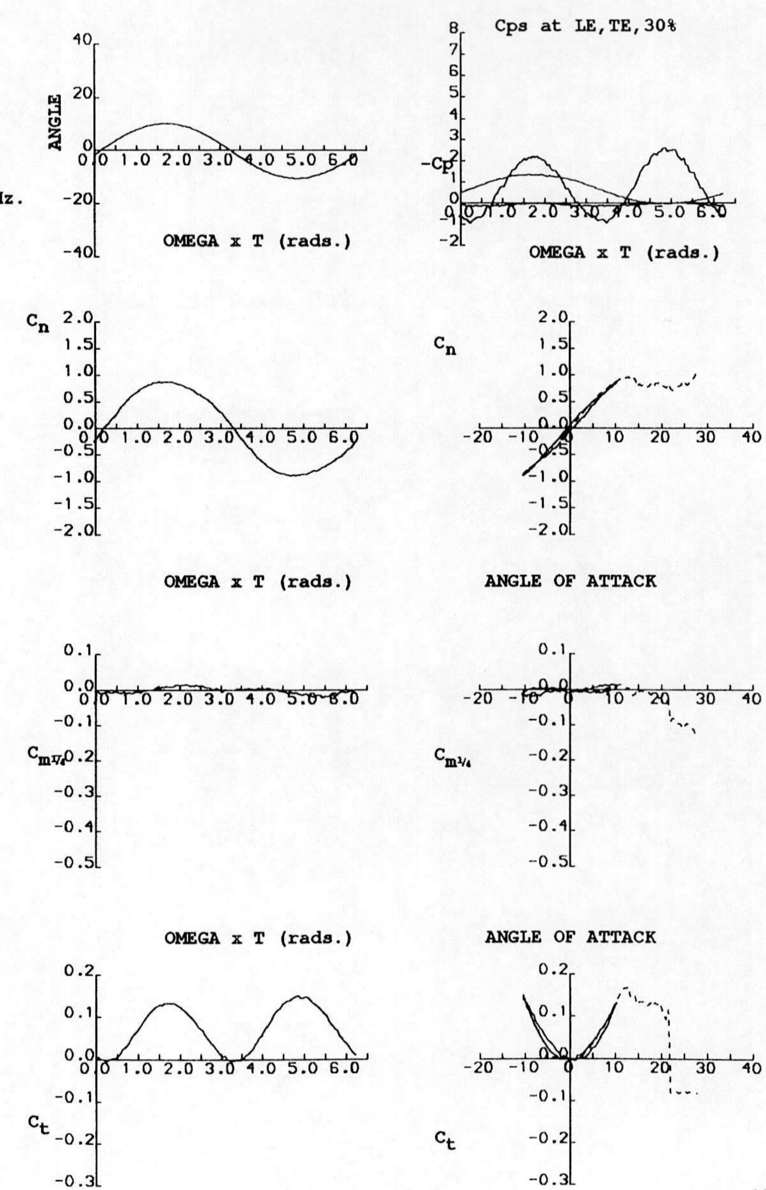




DYNAMIC CHARACTERISTICS FOR THE GUVA10

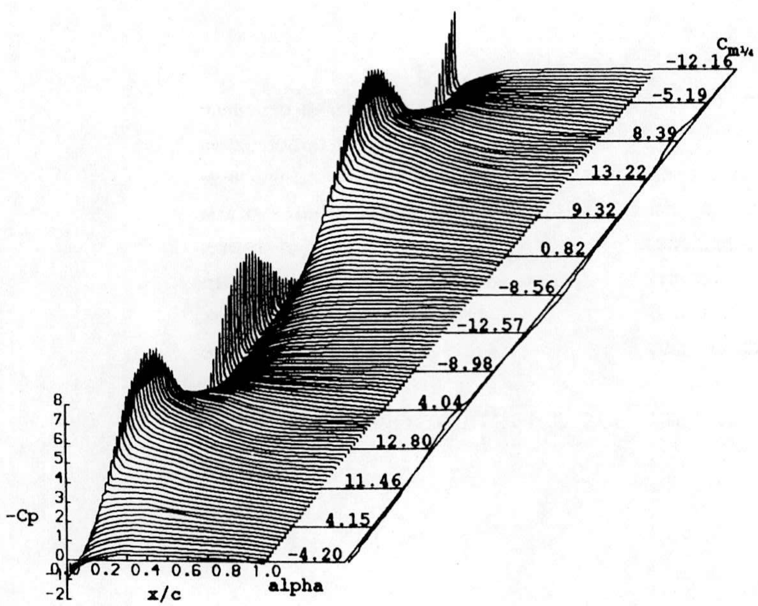
RUN REFERENCE NUMBER: 14961	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1468258.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 963.96 Nm^{-2}	AIR TEMPERATURE = 22.8°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.042
MEAN ANGLE = 0.00°	AMPLITUDE = 10.00°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	

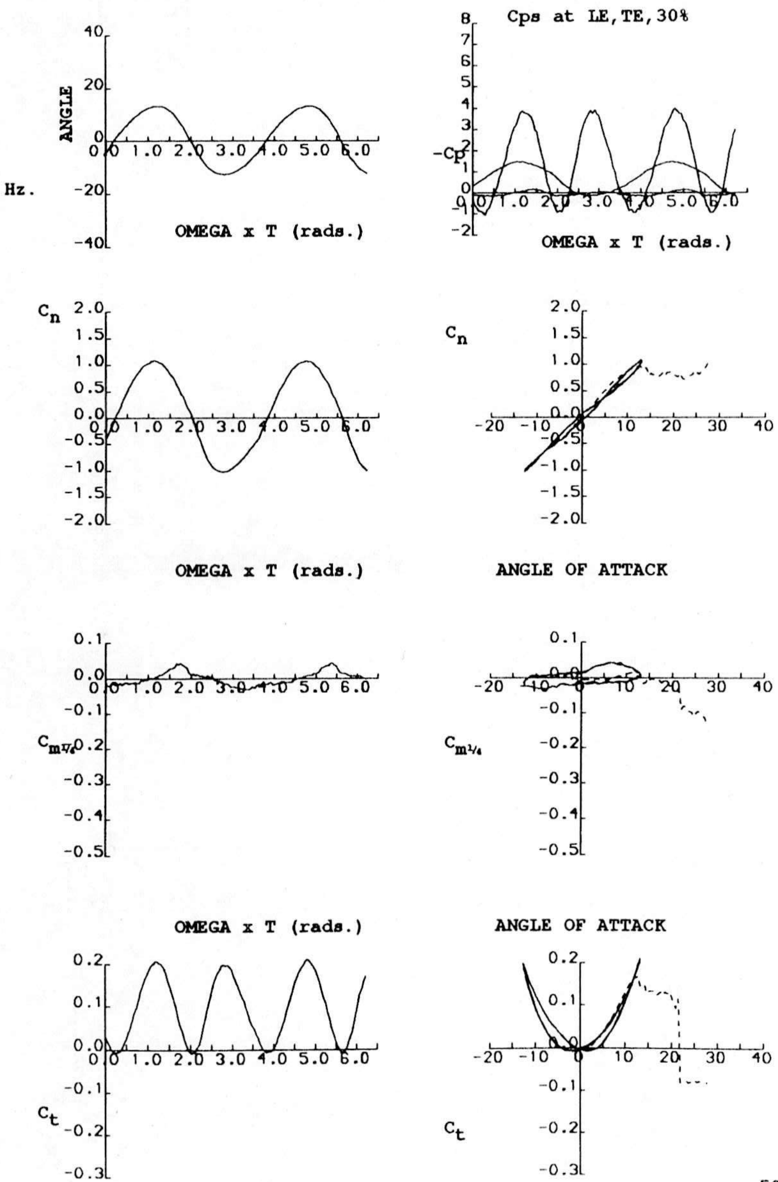




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55031	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1490516.	MACH NUMBER = 0.118
DYNAMIC PRESSURE = 976.71 Nm^{-2}	AIR TEMPERATURE = 20.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.042
MEAN ANGLE = 0.00°	AMPLITUDE = 10.00°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	

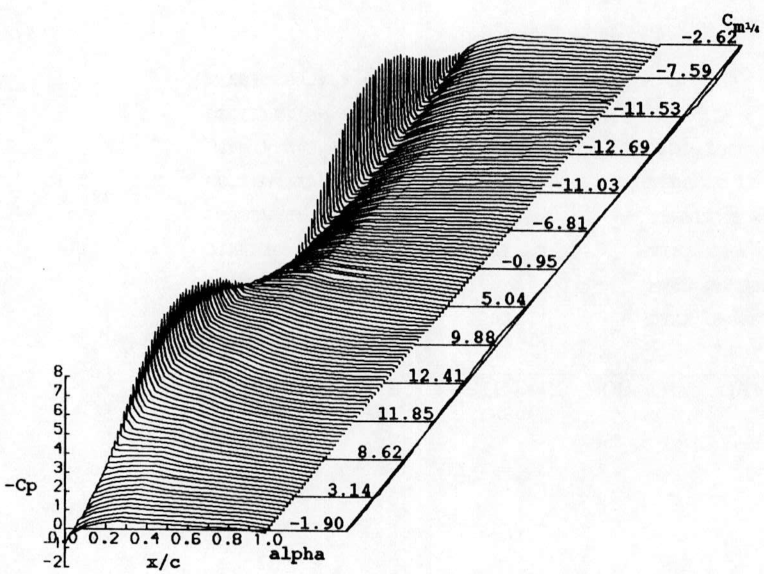


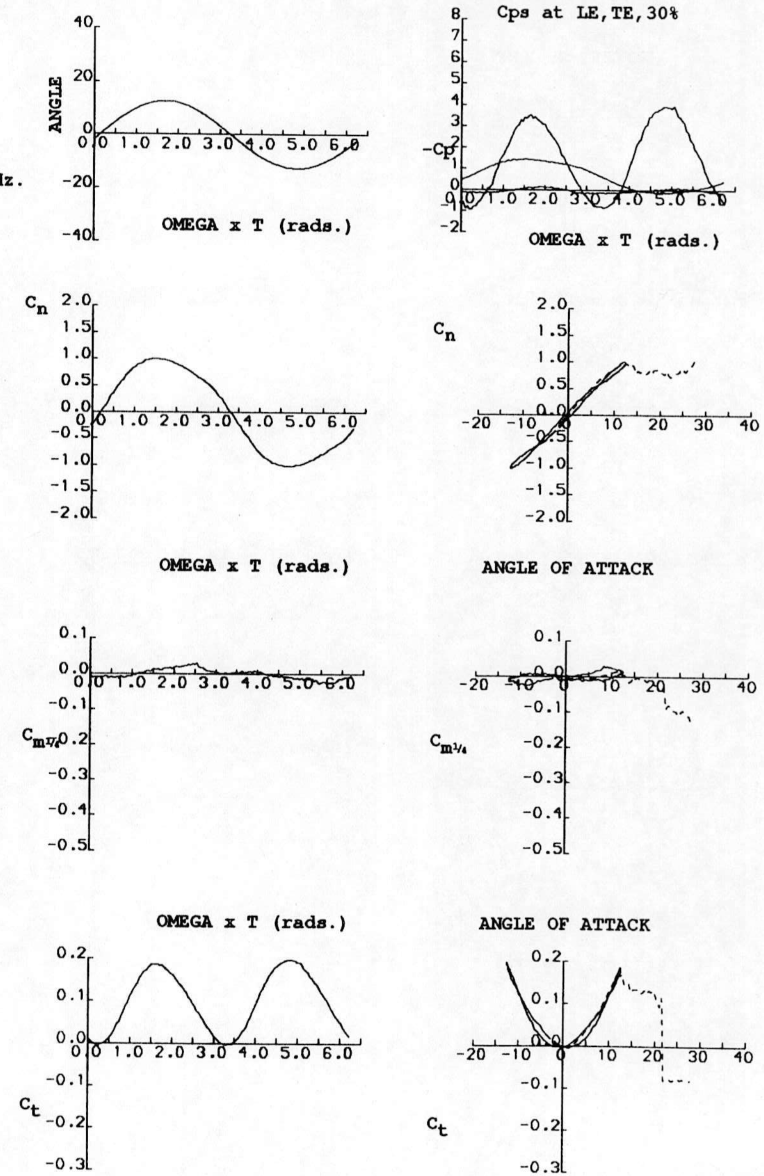


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14971
REYNOLDS NUMBER = 1466985.
DYNAMIC PRESSURE = 963.96 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.0°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.042
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55041

REYNOLDS NUMBER = 1489212.

DYNAMIC PRESSURE = 976.71 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

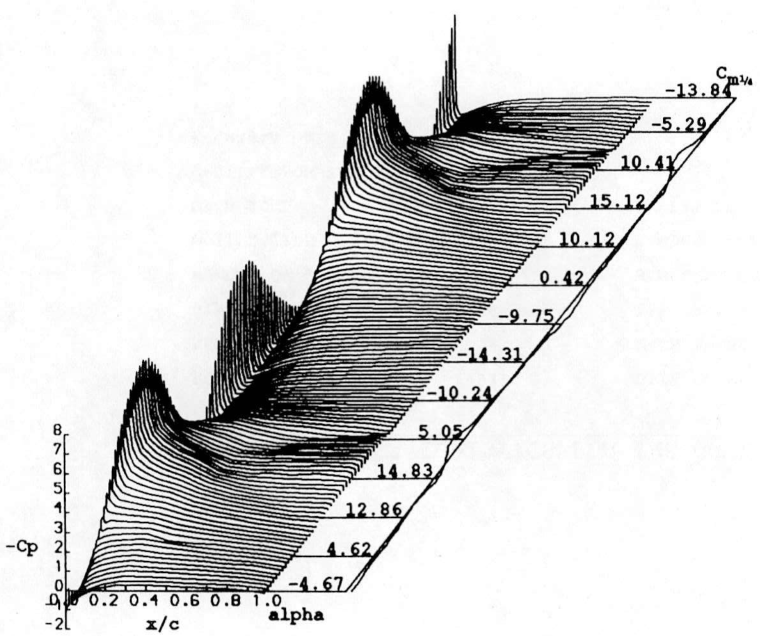
MACH NUMBER = 0.118

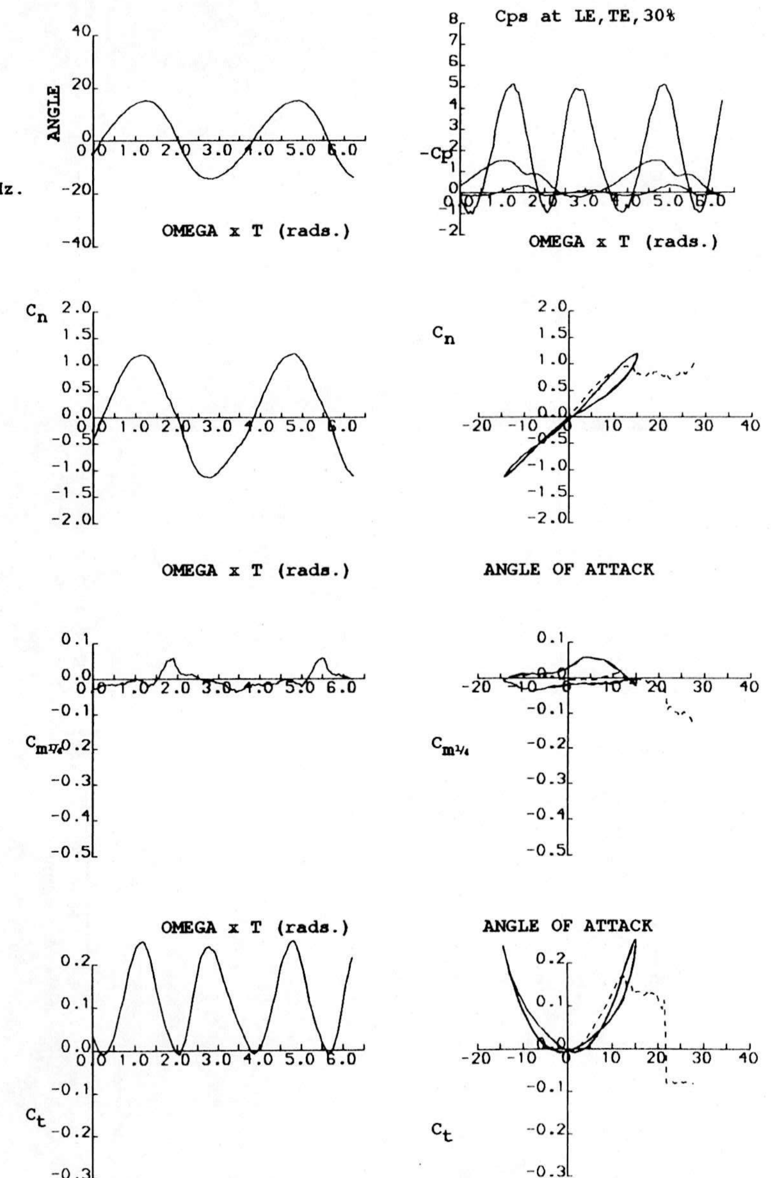
AIR TEMPERATURE = 20.6°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.042

AMPLITUDE = 12.20°

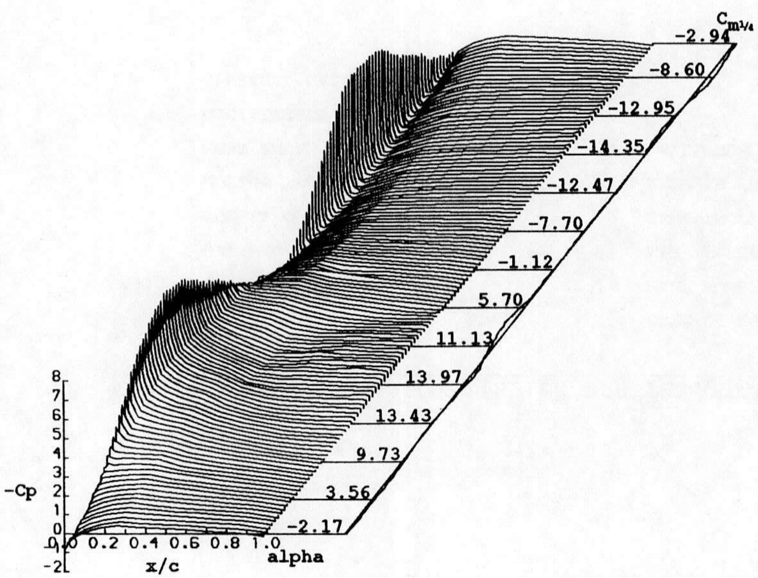


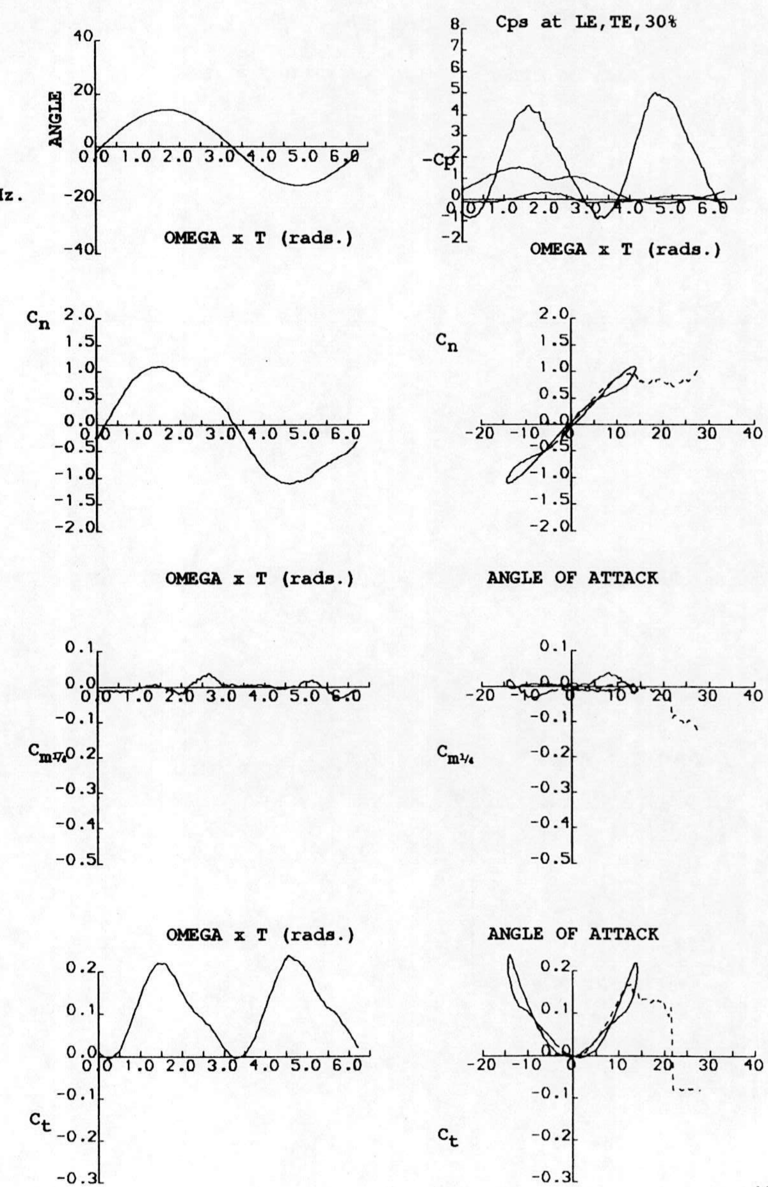


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14981
REYNOLDS NUMBER = 1466350.
DYNAMIC PRESSURE = 963.96 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

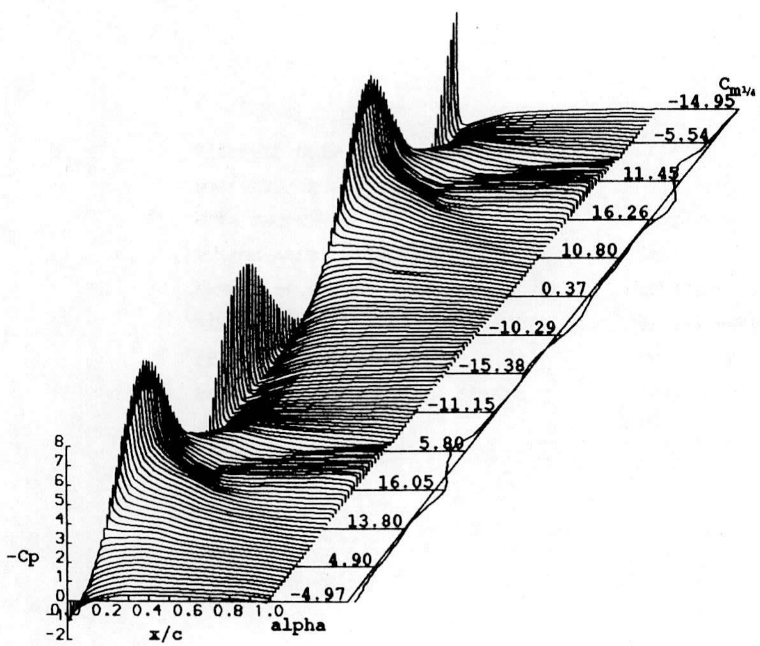
DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.1°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.042
AMPLITUDE = 13.80°

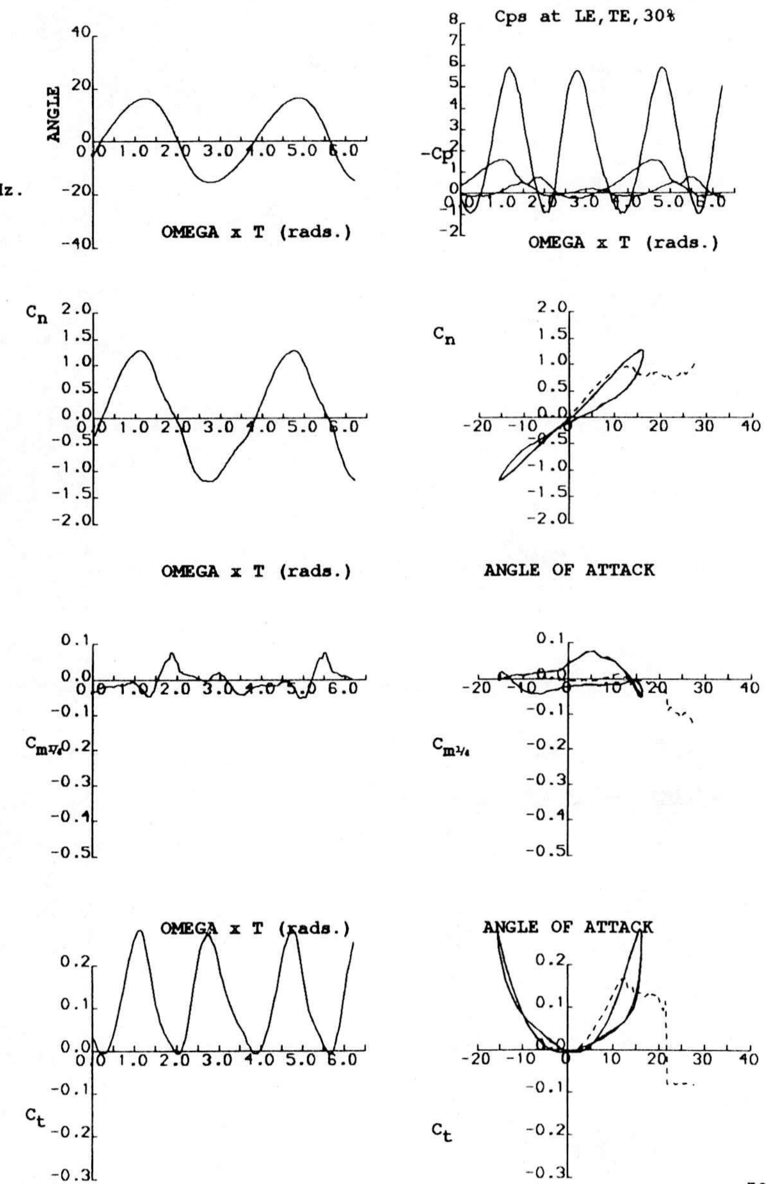




DYNAMIC CHARACTERISTICS FOR THE GUVA10

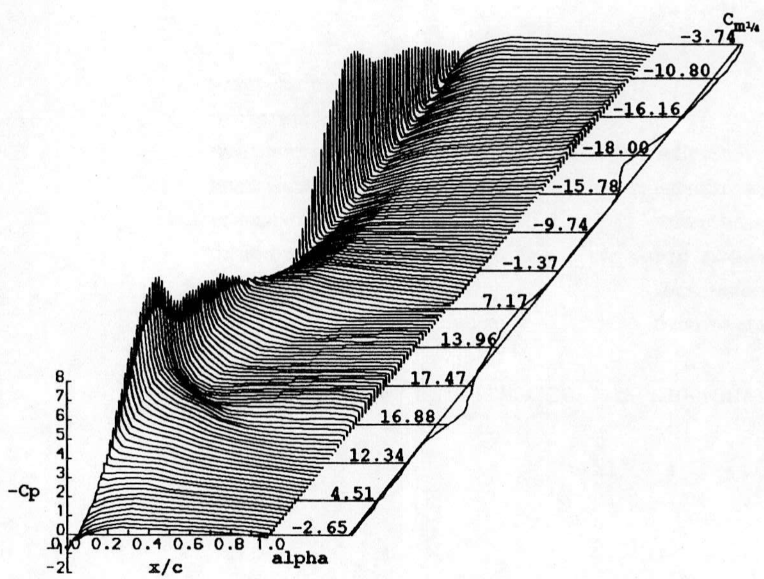
RUN REFERENCE NUMBER: 55051	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1487910.	MACH NUMBER = 0.118
DYNAMIC PRESSURE = 976.71 Nm^{-2}	AIR TEMPERATURE = 20.8°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.042
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	

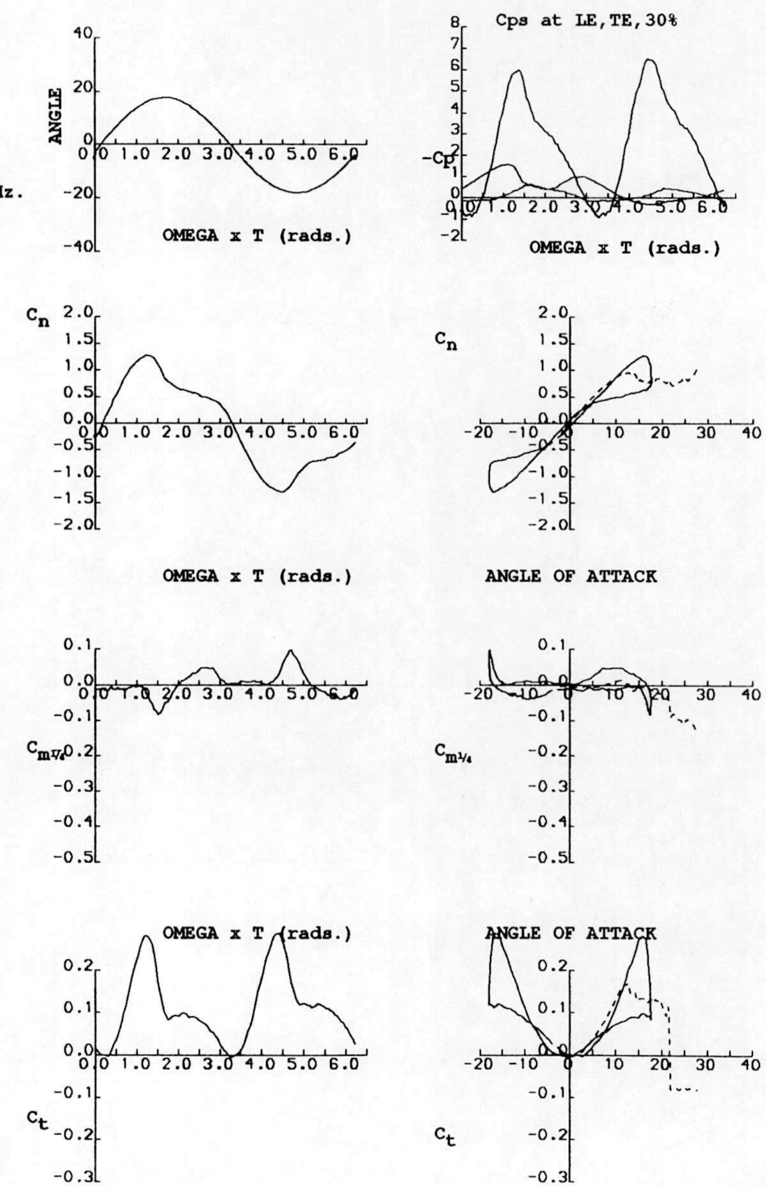




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 14991	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1465715.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 963.96 Nm^{-2}	AIR TEMPERATURE = 23.2°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.042
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55061

REYNOLDS NUMBER = 1486611.

DYNAMIC PRESSURE = 976.71 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

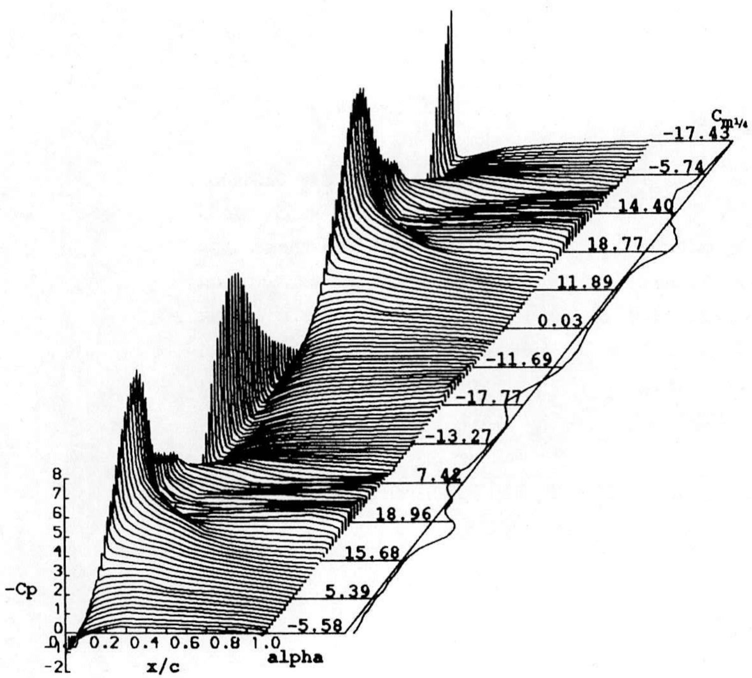
MACH NUMBER = 0.118

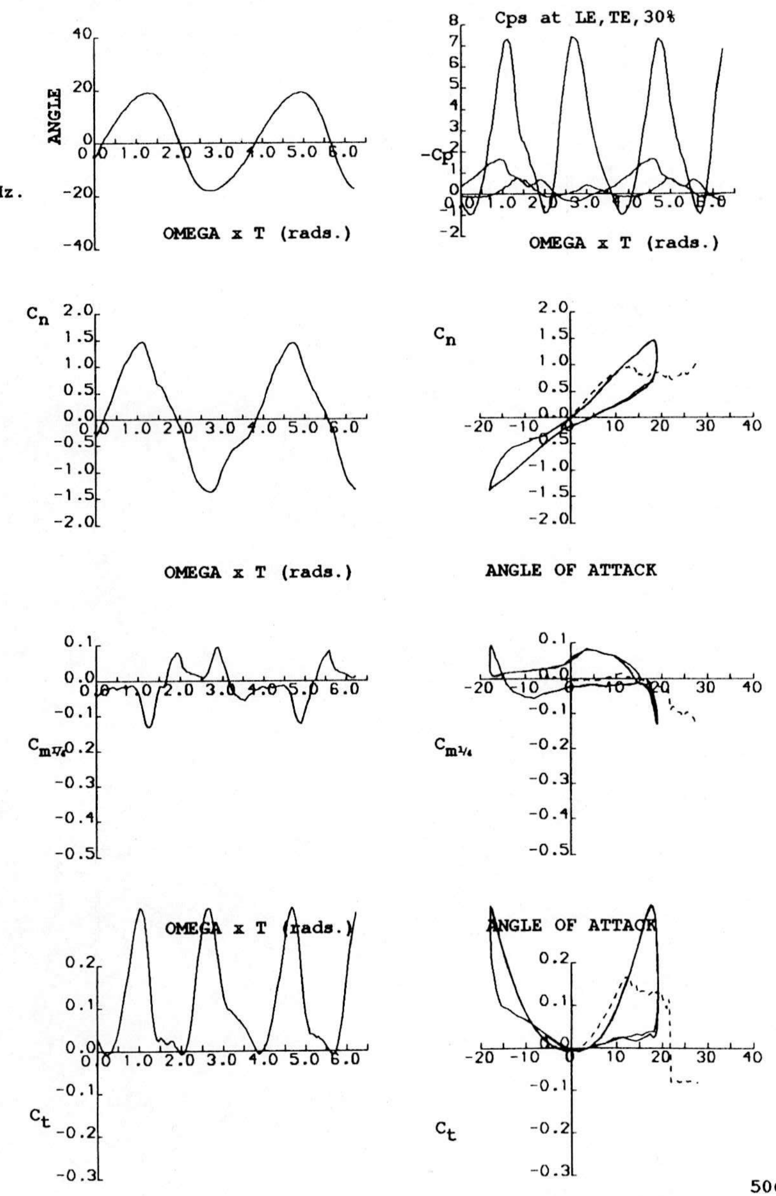
AIR TEMPERATURE = 21.0°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.042

AMPLITUDE = 17.40°





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DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15001

REYNOLDS NUMBER = 1465081.

DYNAMIC PRESSURE = 963.96 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

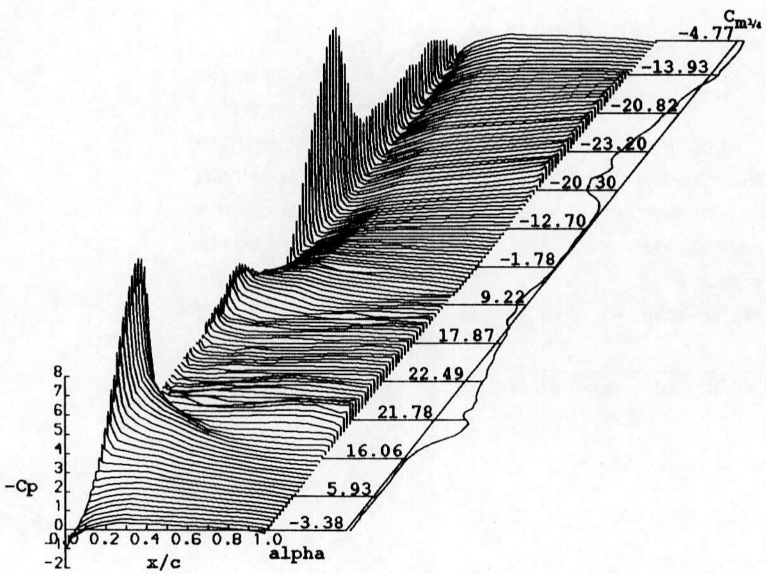
MACH NUMBER = 0.117

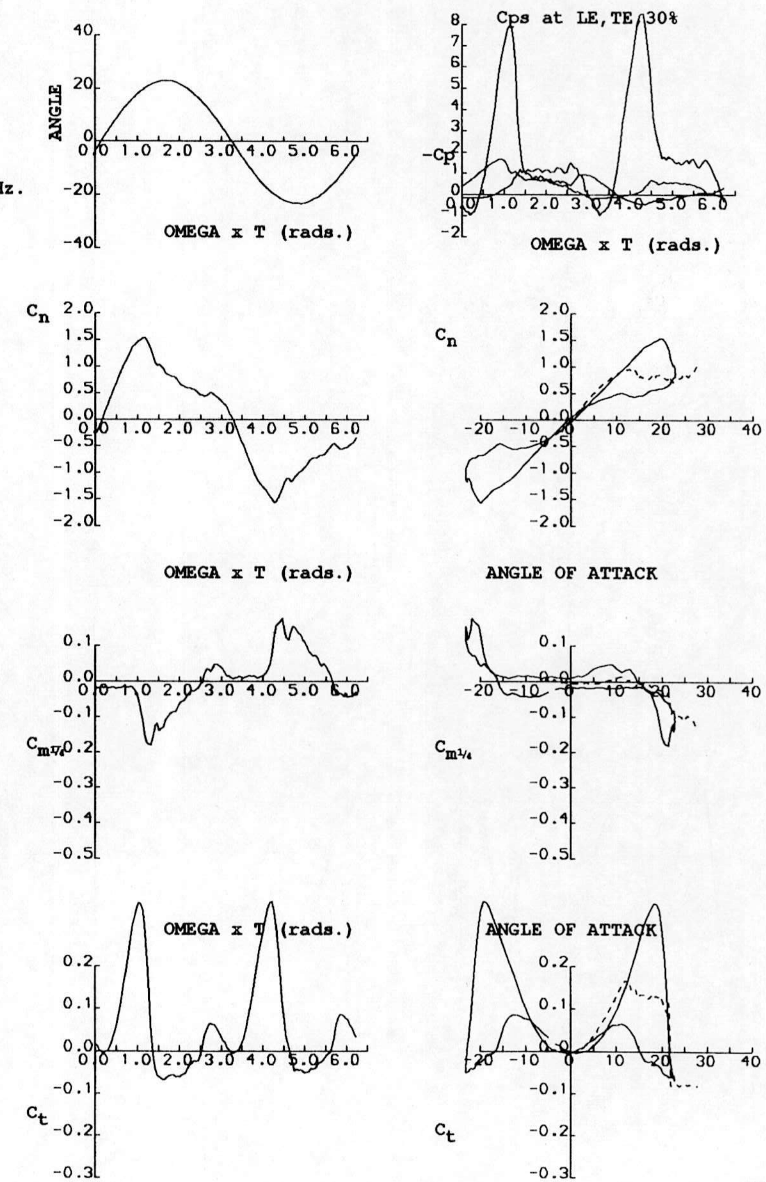
AIR TEMPERATURE = 23.3°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.042

AMPLITUDE = 22.60°

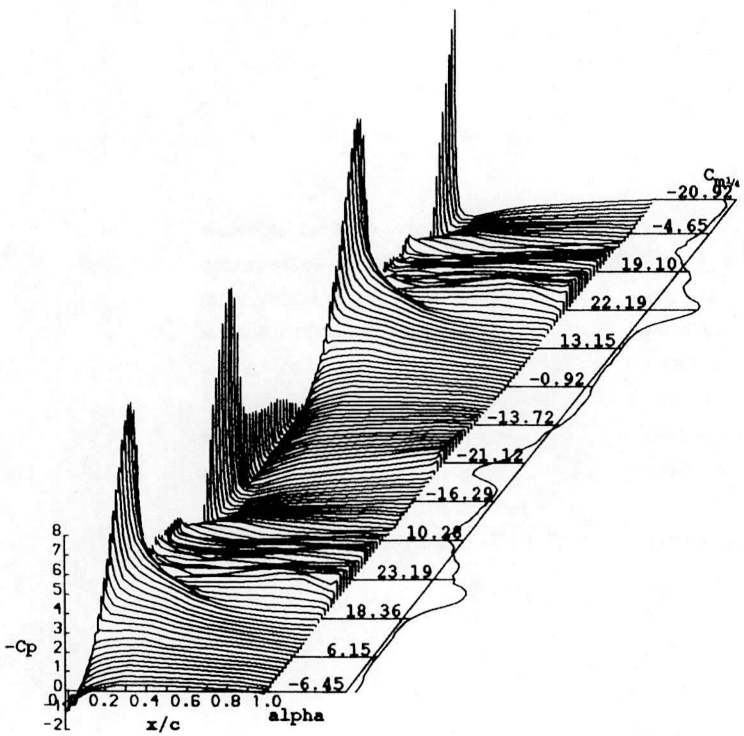


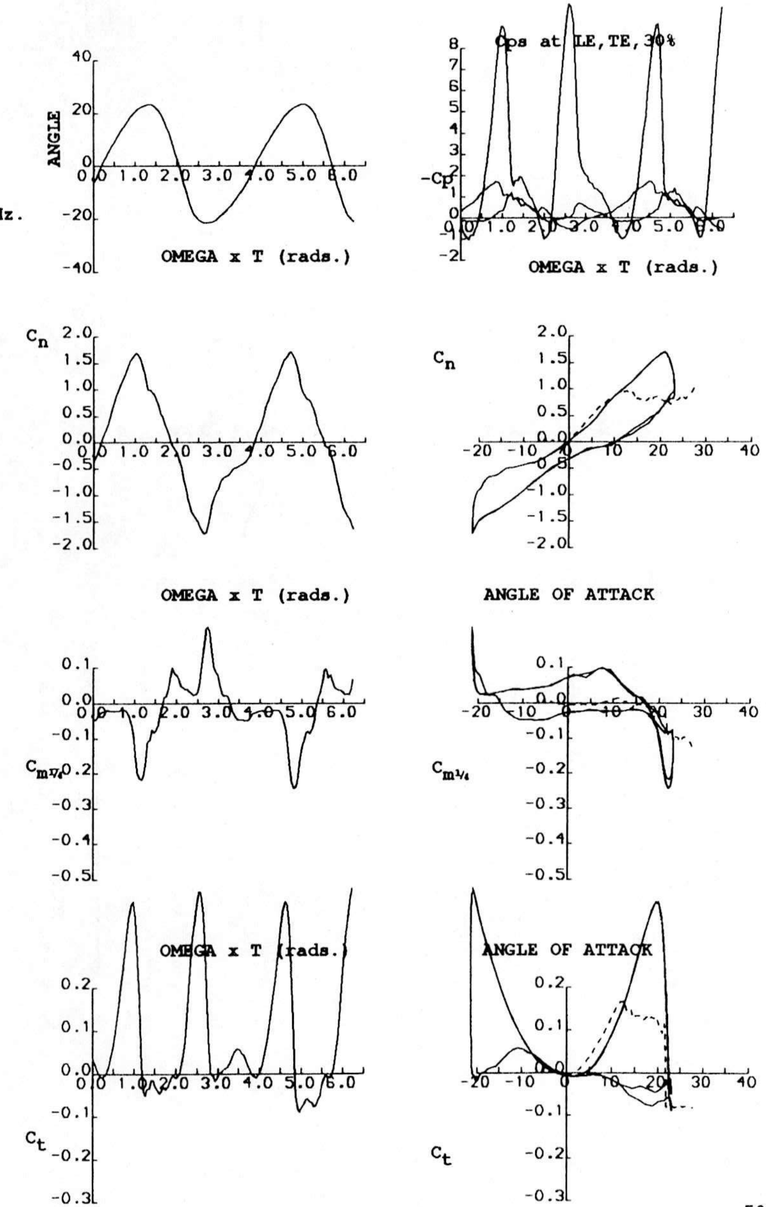


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55071
REYNOLDS NUMBER = 1485313.
DYNAMIC PRESSURE = 976.71 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.2°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.042
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15011

REYNOLDS NUMBER = 1463814.

DYNAMIC PRESSURE = 963.96 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

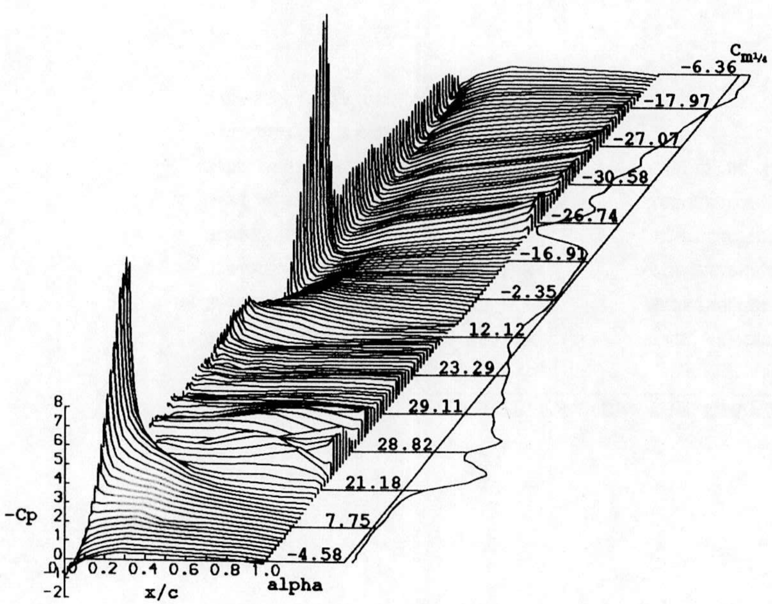
MACH NUMBER = 0.117

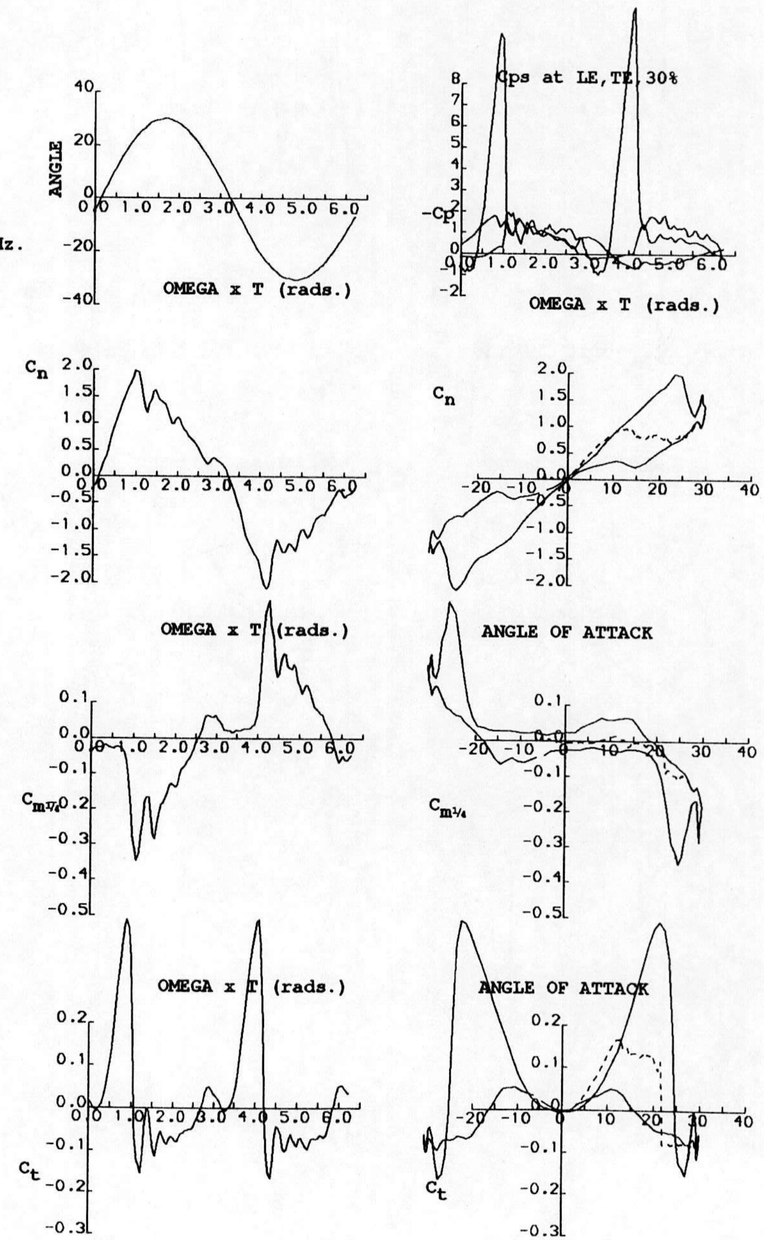
AIR TEMPERATURE = 23.5°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.042

AMPLITUDE = 30.00°

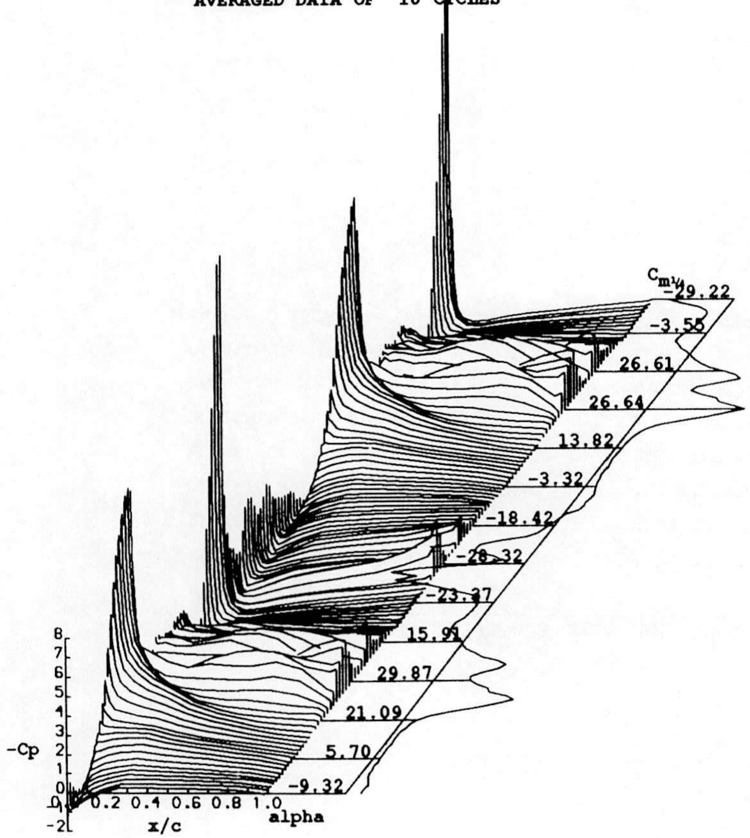


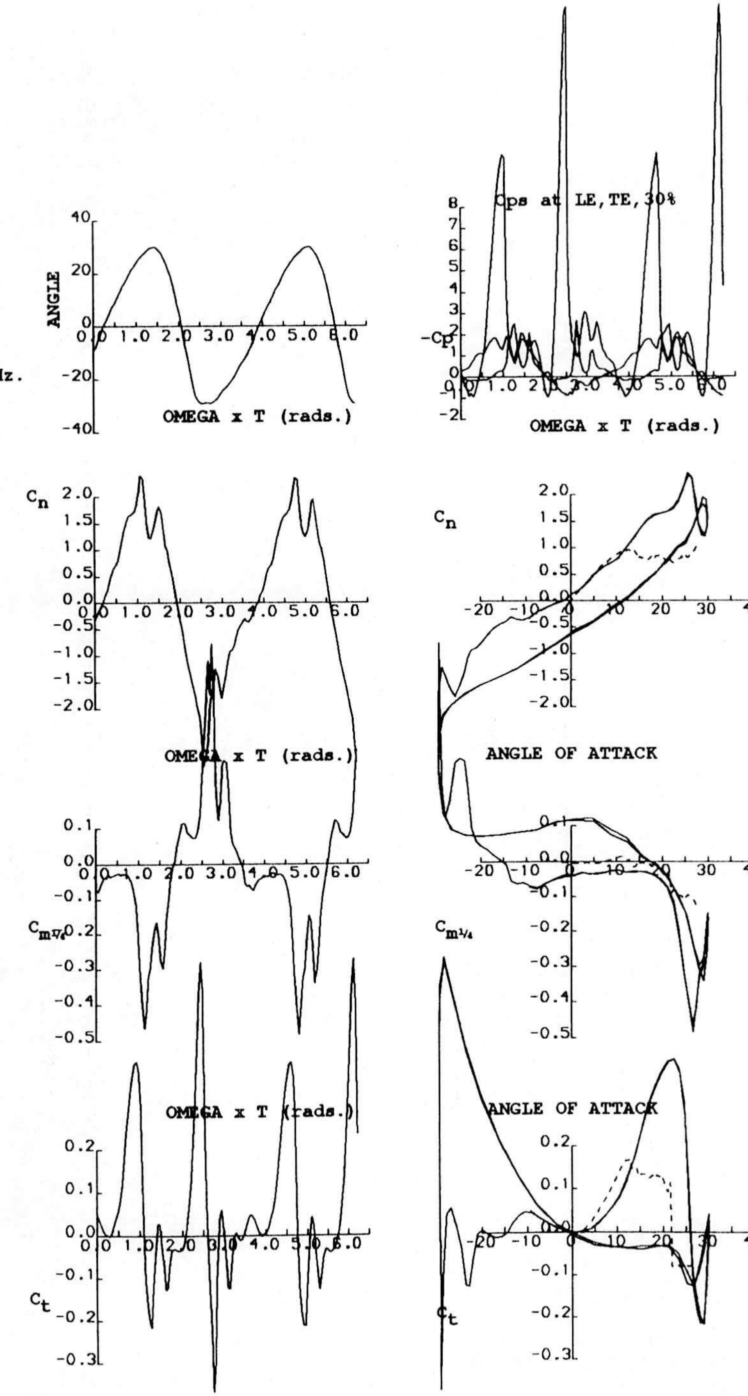


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55081
REYNOLDS NUMBER = 1483646.
DYNAMIC PRESSURE = 975.37 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

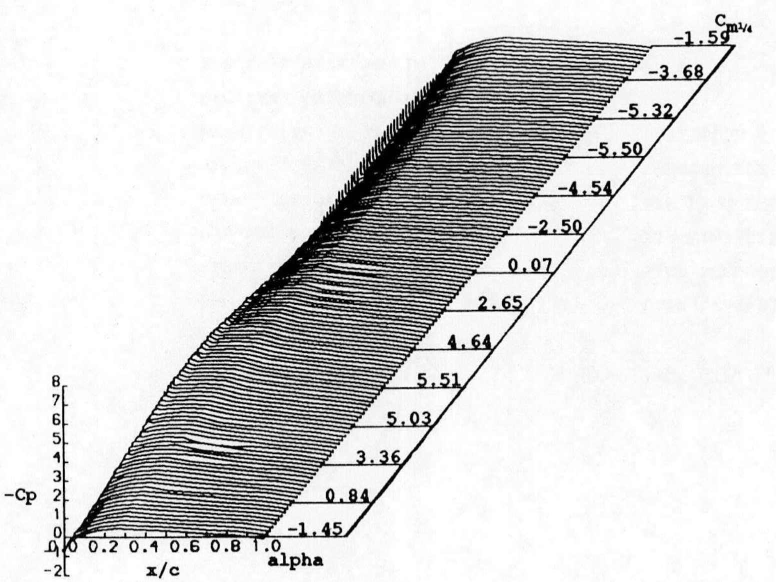
DATE OF TEST: 5/3/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.3°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.042
AMPLITUDE = 30.00°

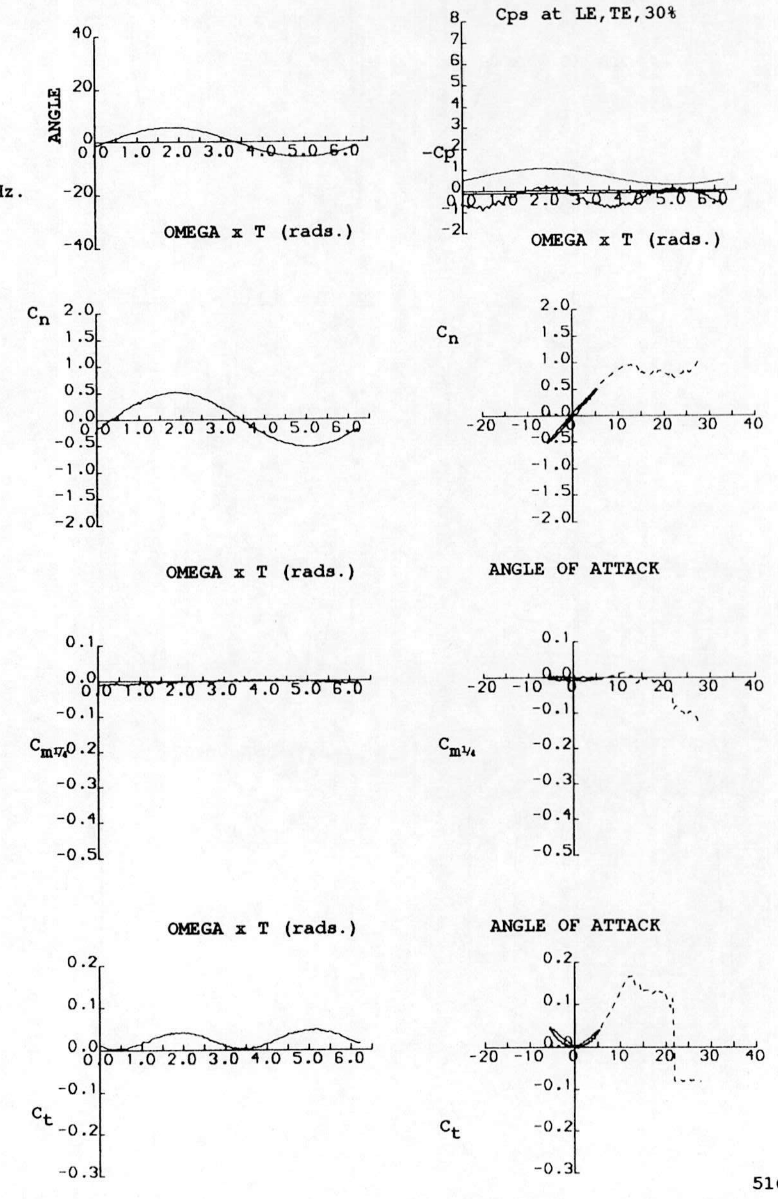




DYNAMIC CHARACTERISTICS FOR THE GUVA10

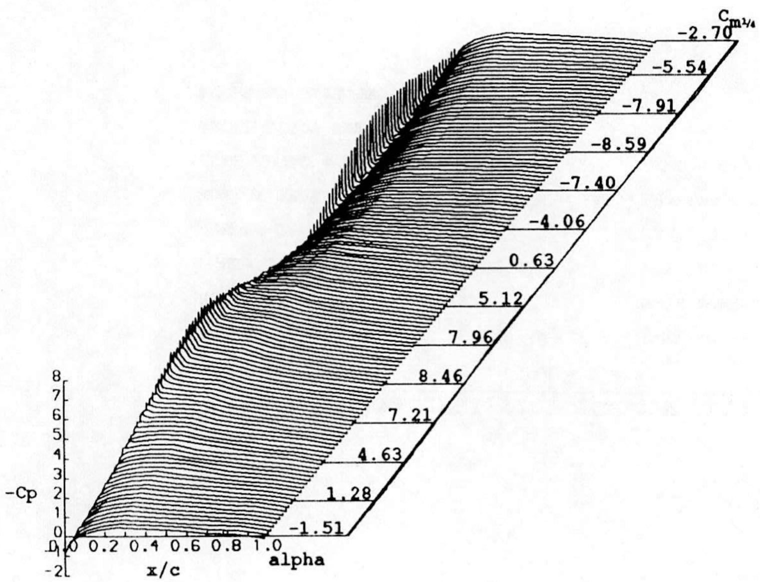
RUN REFERENCE NUMBER: 15161	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1470835.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.82 Nm^{-2}	AIR TEMPERATURE = 22.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 5.40°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	

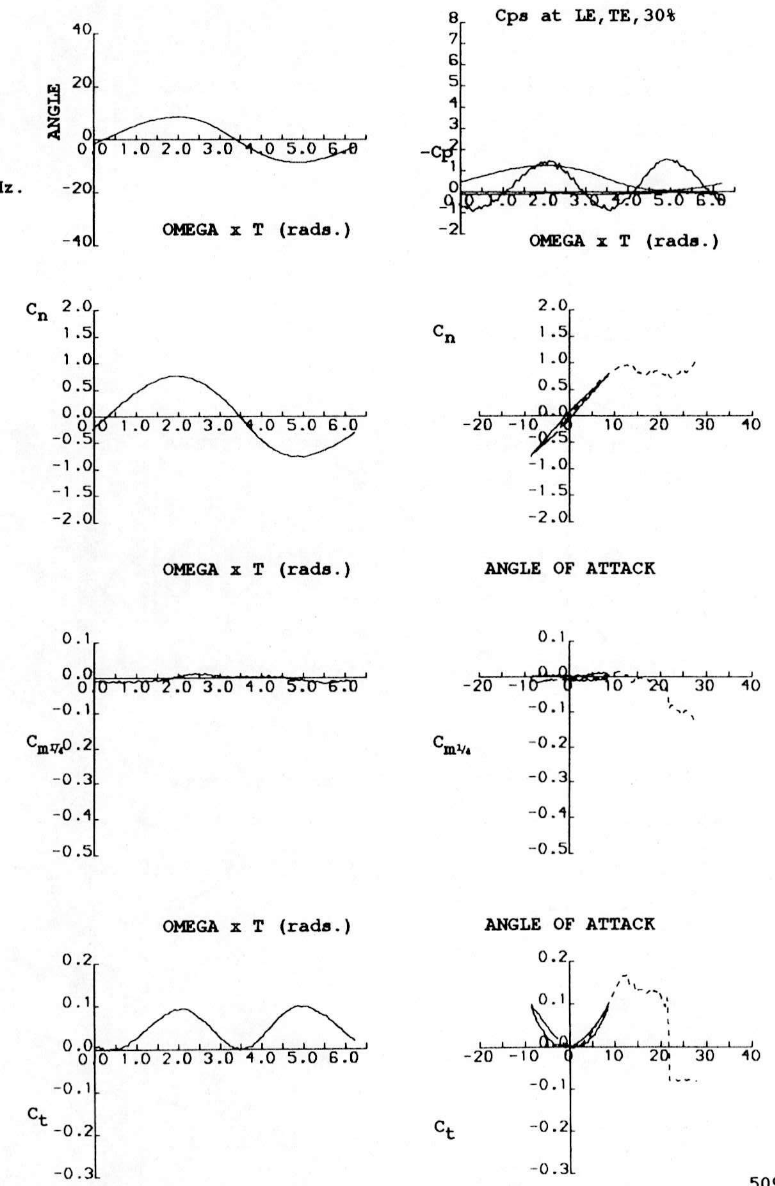




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55091	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1461533.	MACH NUMBER = 0.116
DYNAMIC PRESSURE = 949.82 Nm^{-2}	AIR TEMPERATURE = 21.7°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 5.40°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15171

REYNOLDS NUMBER = 1470197.

DYNAMIC PRESSURE = 967.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

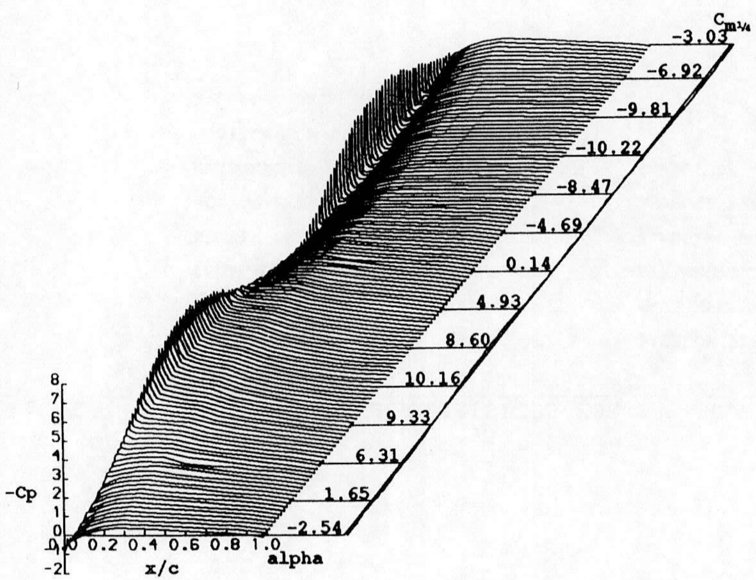
MACH NUMBER = 0.117

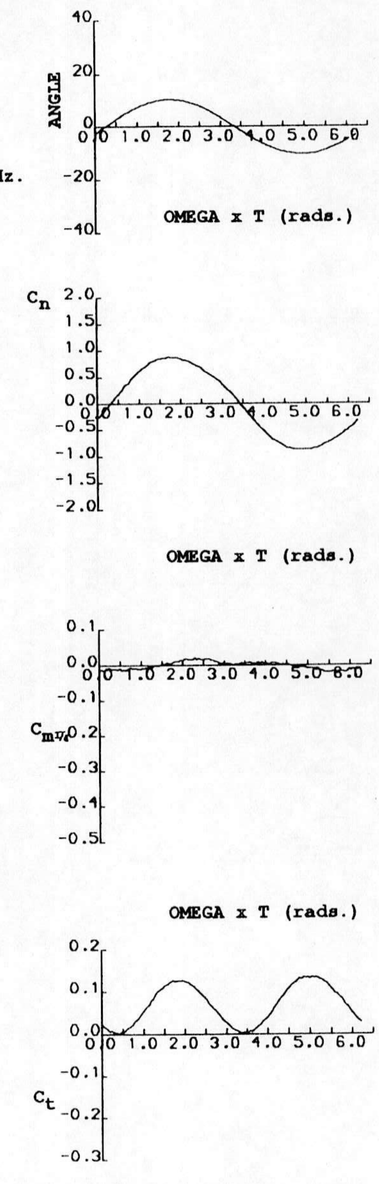
AIR TEMPERATURE = 22.5°C

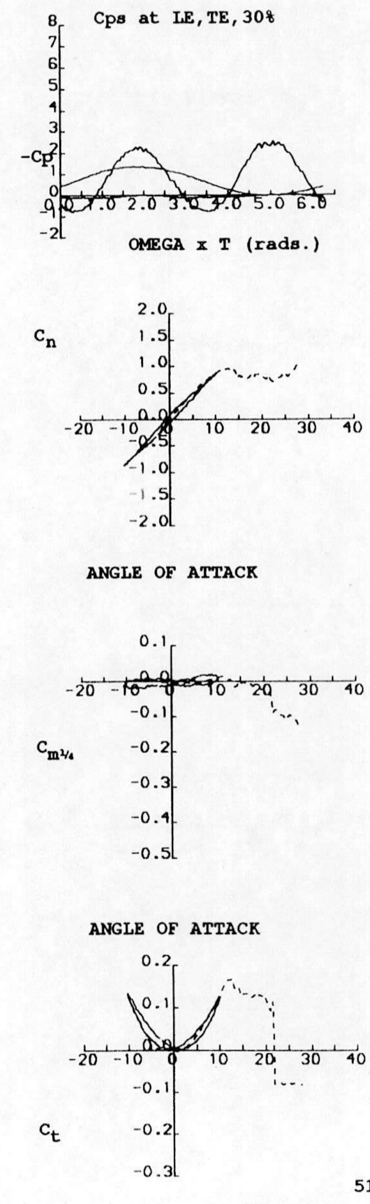
SAMPLING FREQUENCY = 187.27 Hz.

REDUCED FREQUENCY = 0.063

AMPLITUDE = 10.00°







DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55101

REYNOLDS NUMBER = 1459626.

DYNAMIC PRESSURE = 949.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

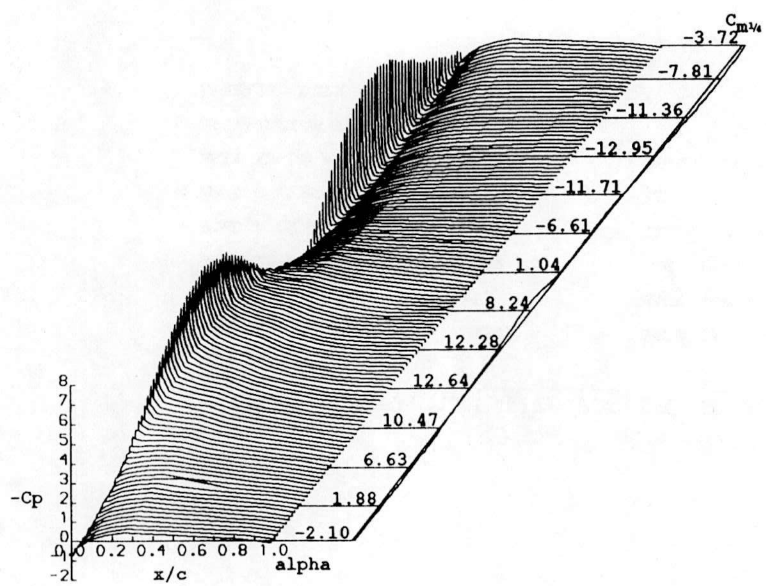
MACH NUMBER = 0.116

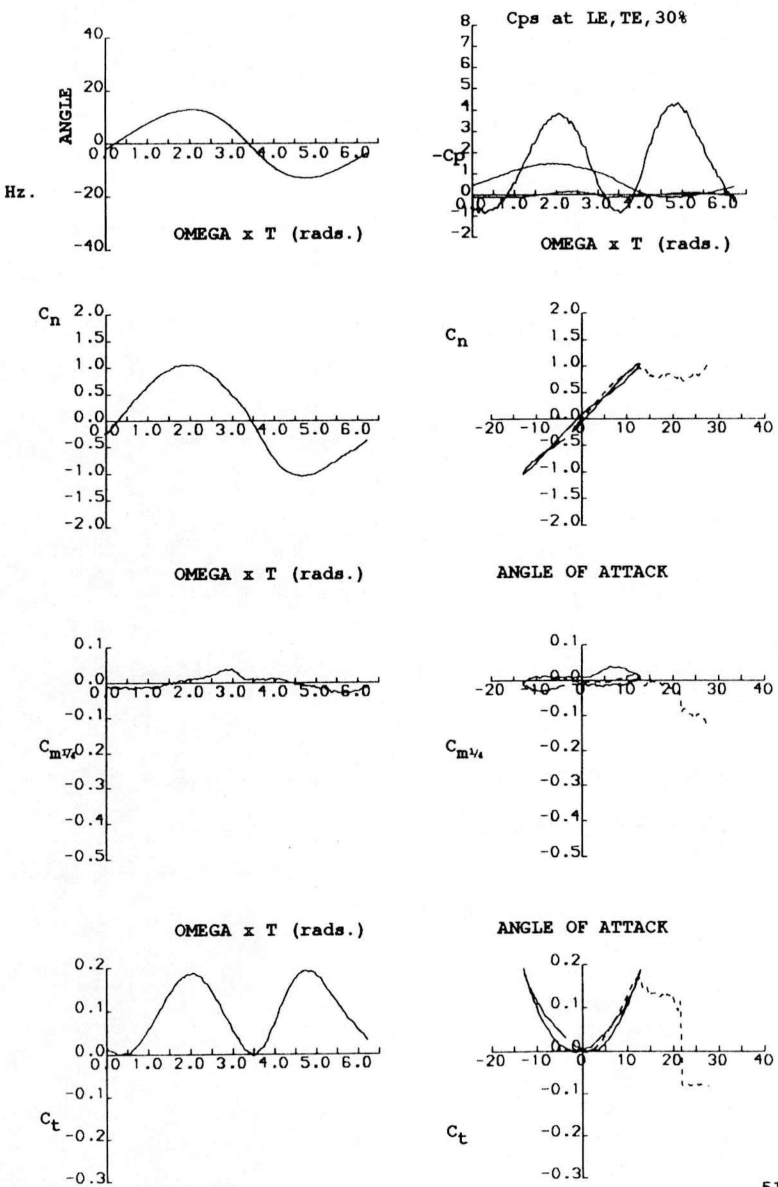
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 187.27 Hz.

REDUCED FREQUENCY = 0.063

AMPLITUDE = 10.00°

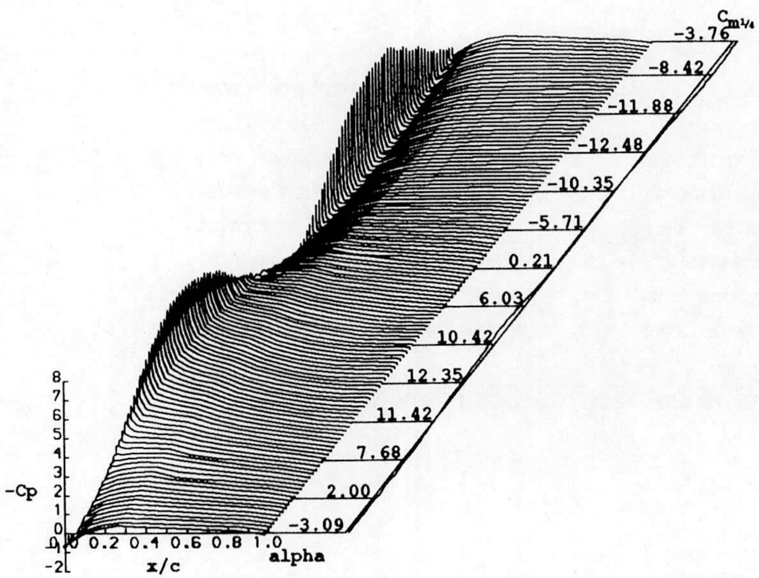


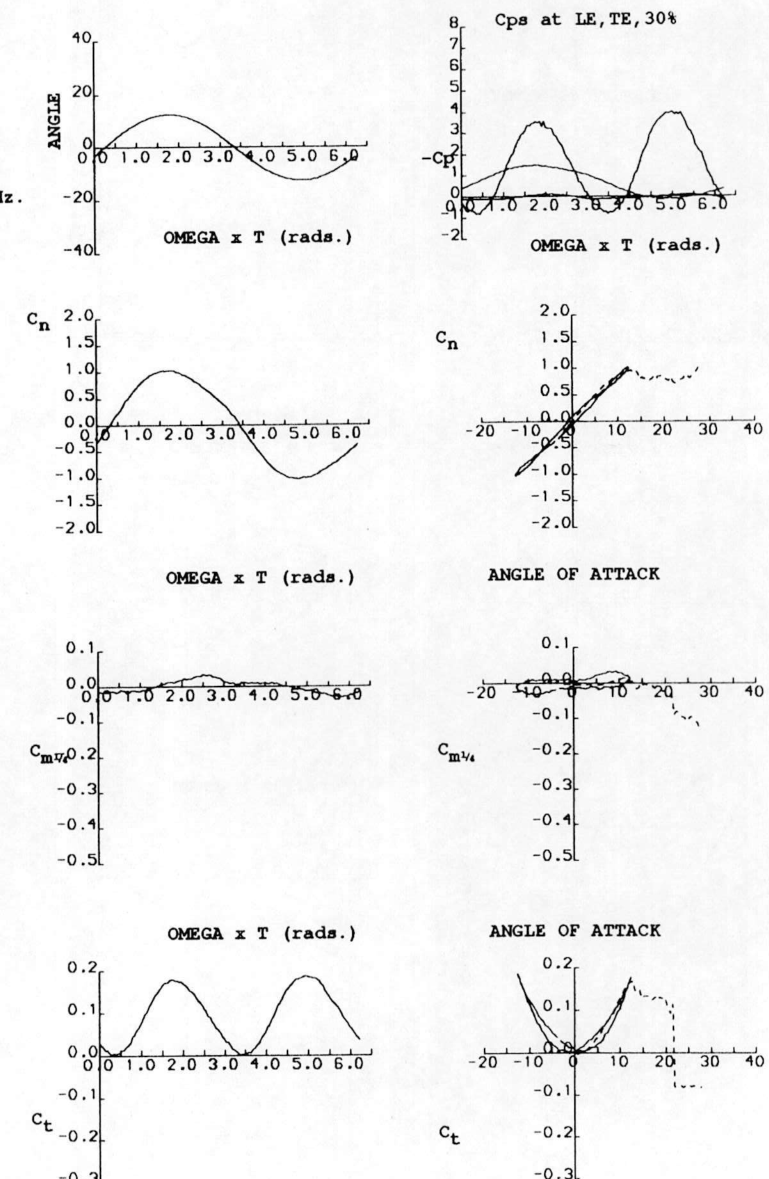


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15181
REYNOLDS NUMBER = 1468921.
DYNAMIC PRESSURE = 967.82 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.463 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 187.27 Hz.
REDUCED FREQUENCY = 0.063
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55111

REYNOLDS NUMBER = 1458357.

DYNAMIC PRESSURE = 949.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

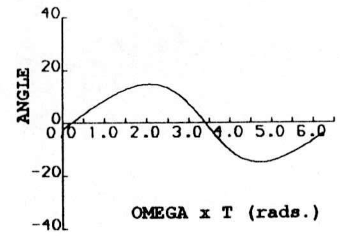
MACH NUMBER = 0.116

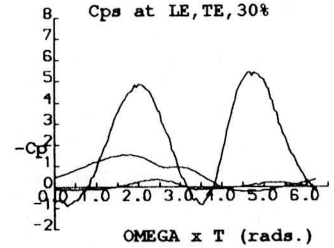
AIR TEMPERATURE = 22.2°C

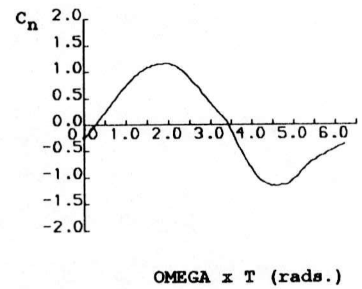
SAMPLING FREQUENCY = 187.27 Hz.

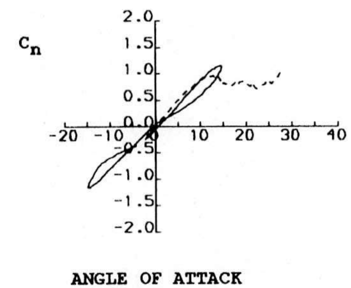
REDUCED FREQUENCY = 0.063

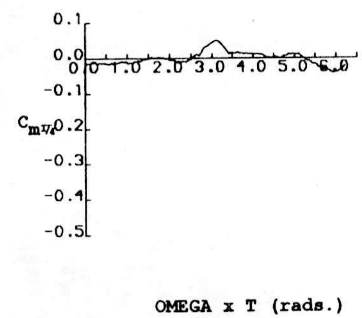
AMPLITUDE = 12.20°

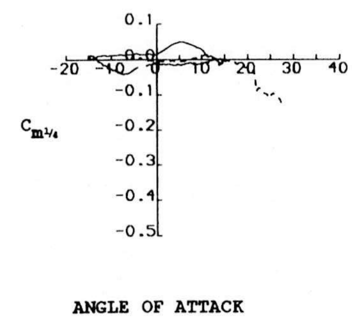


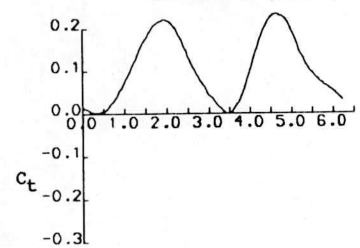


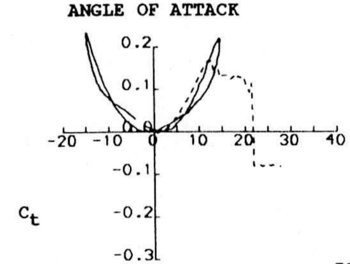


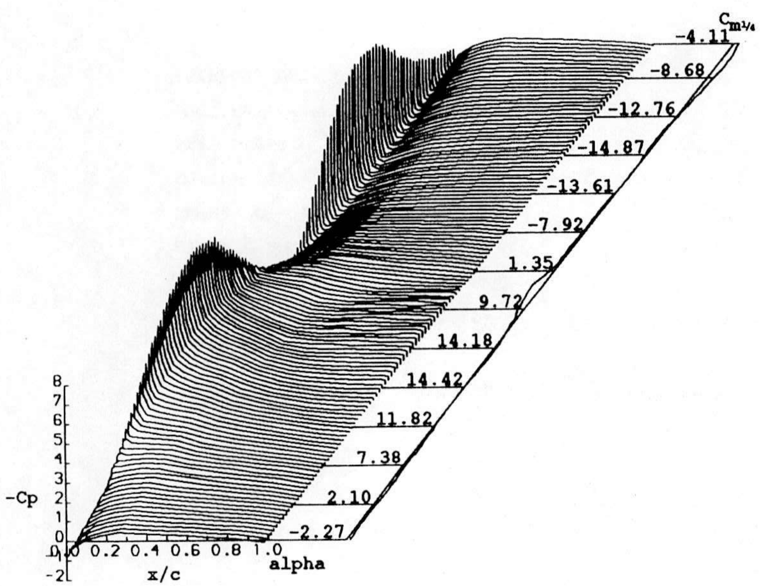












DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15191

REYNOLDS NUMBER = 1468284.

DYNAMIC PRESSURE = 967.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

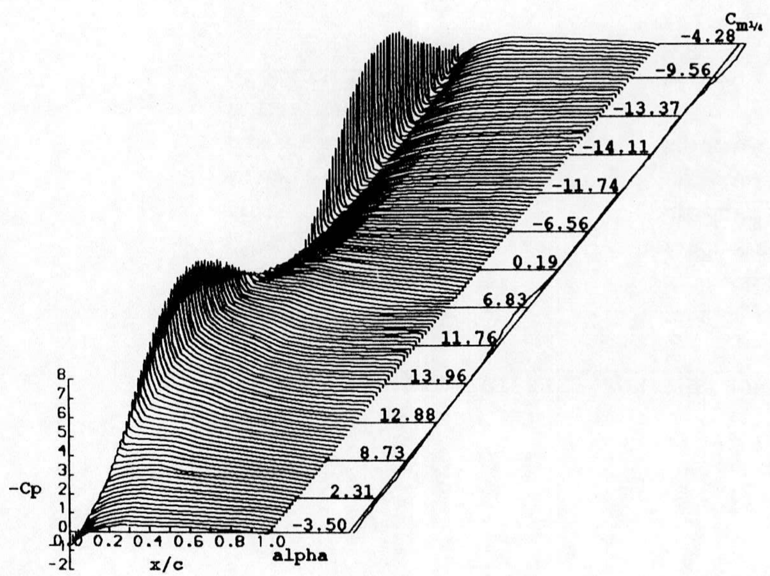
MACH NUMBER = 0.117

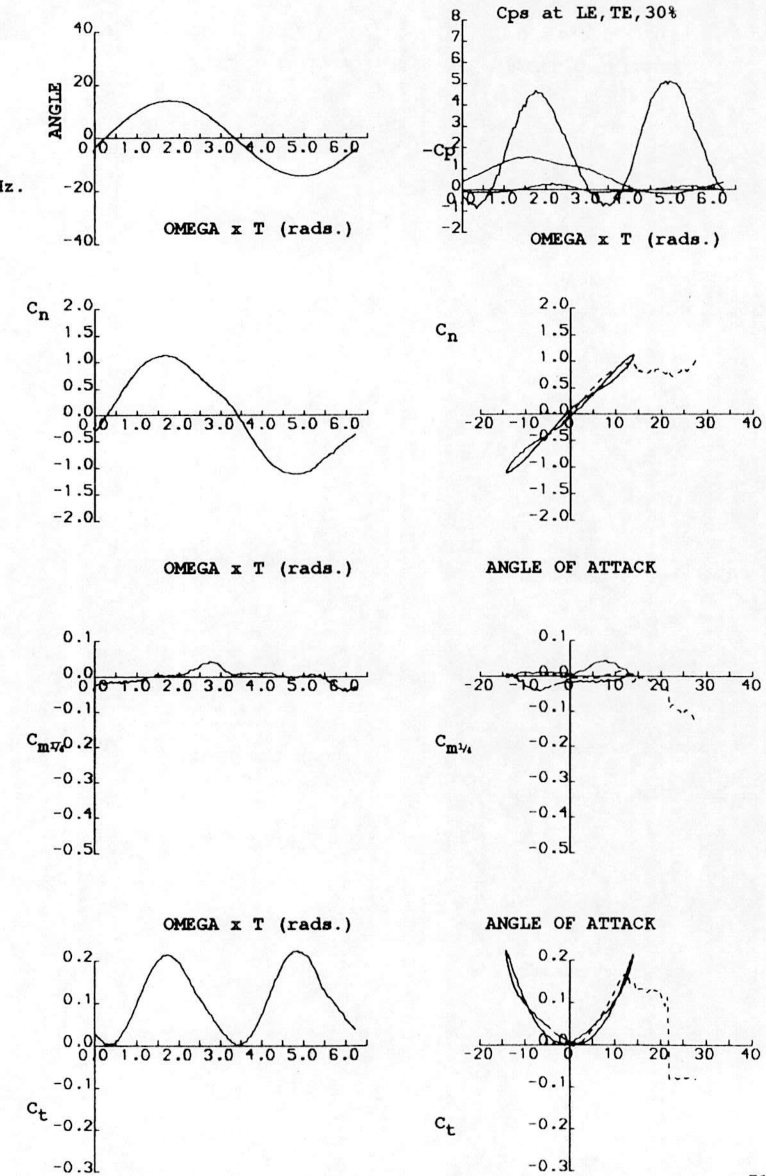
AIR TEMPERATURE = 22.8°C

SAMPLING FREQUENCY = 187.27 Hz.

REDUCED FREQUENCY = 0.063

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55121

REYNOLDS NUMBER = 1456458.

DYNAMIC PRESSURE = 949.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

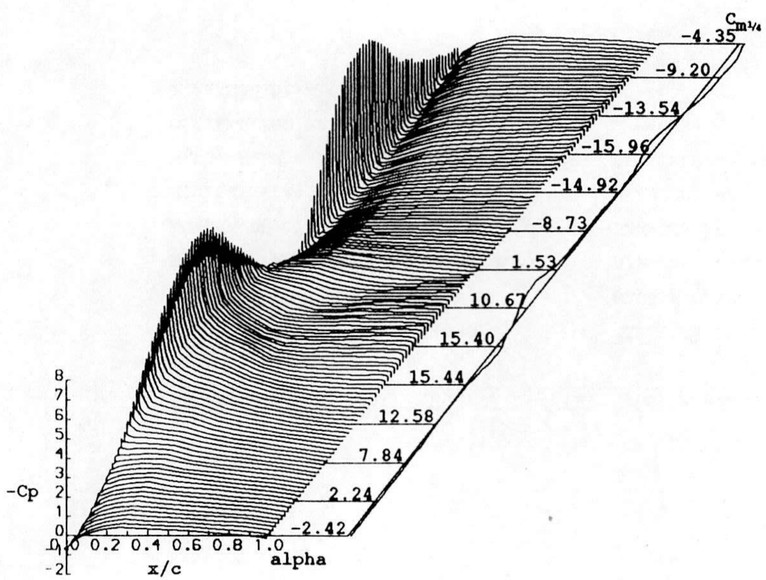
MACH NUMBER = 0.116

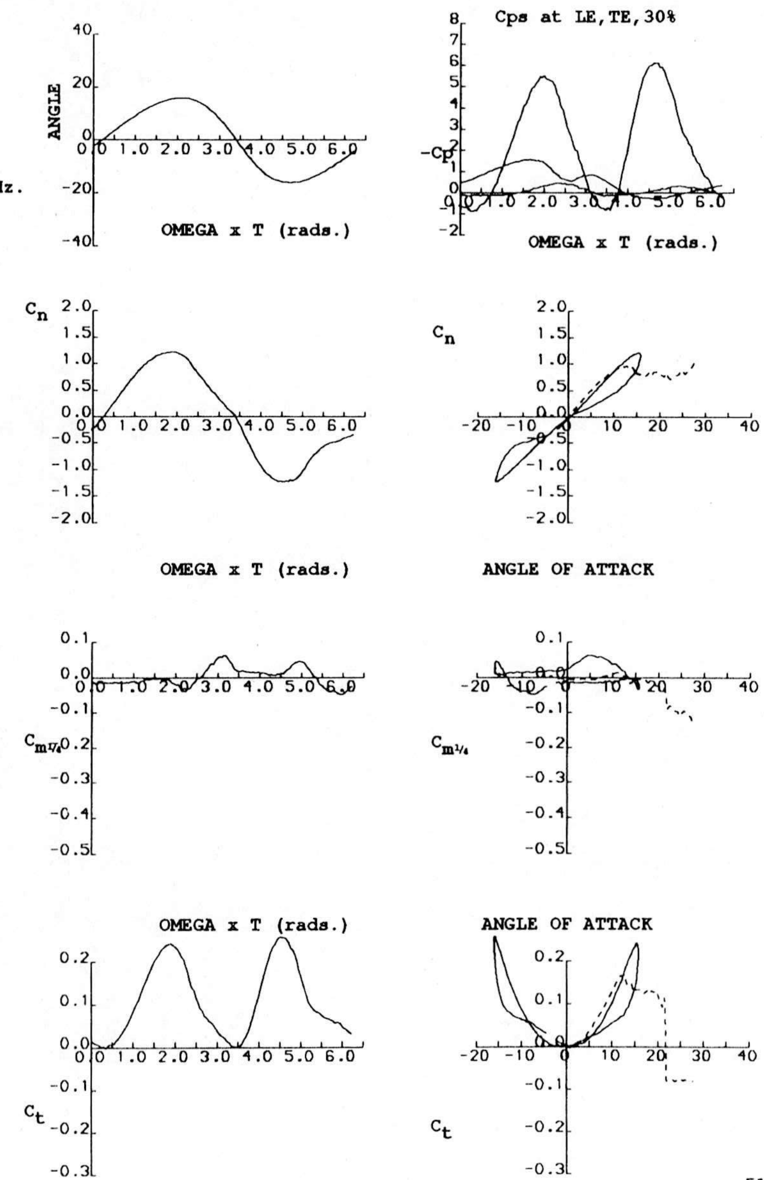
AIR TEMPERATURE = 22.5°C

SAMPLING FREQUENCY = 187.27 Hz.

REDUCED FREQUENCY = 0.063

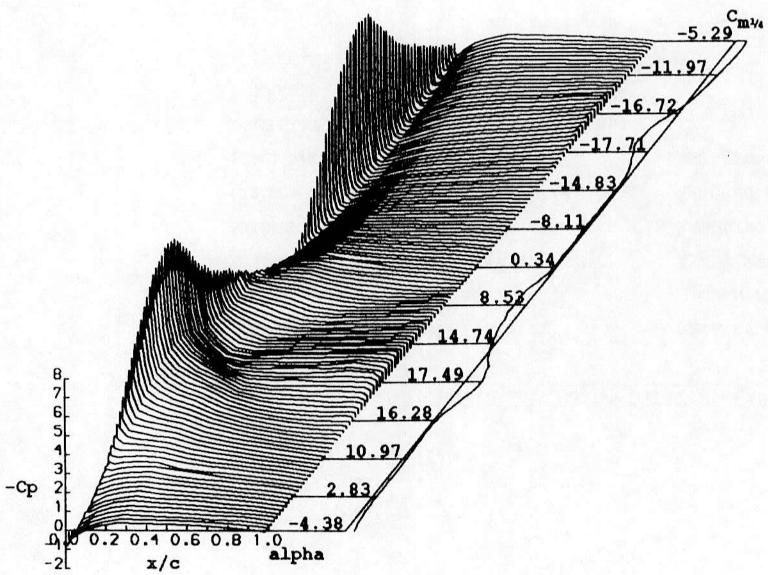
AMPLITUDE = 13.80°

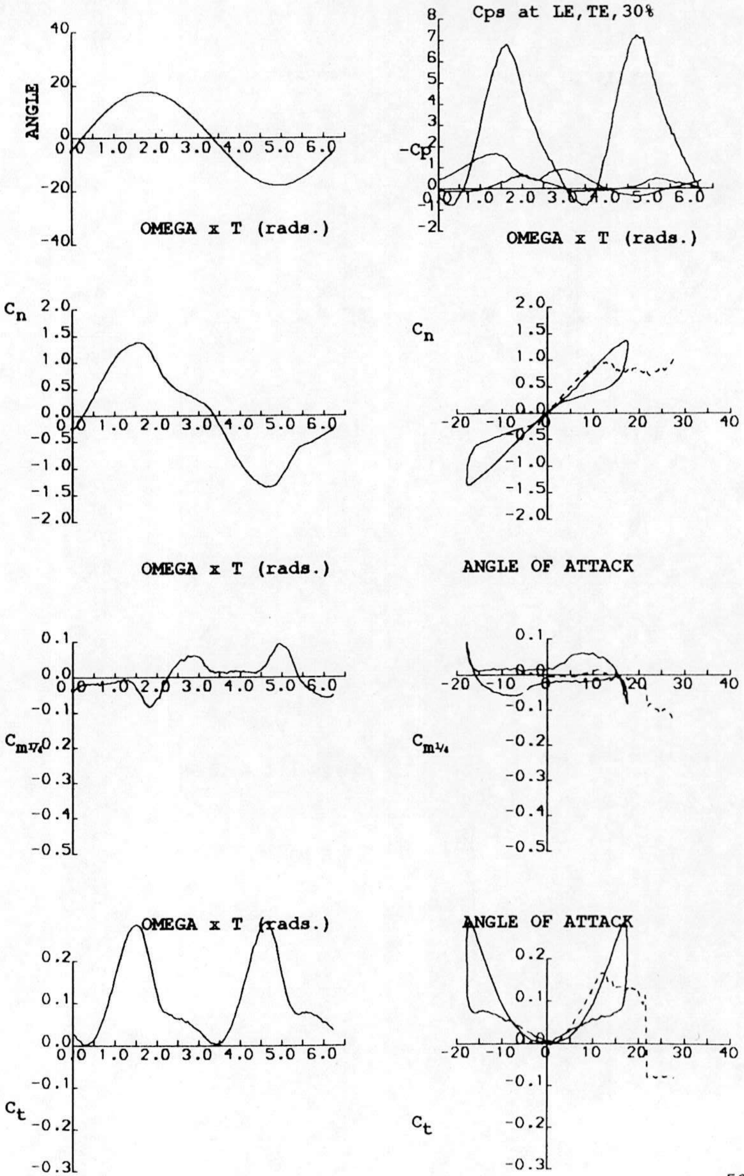




DYNAMIC CHARACTERISTICS FOR THE GUVA10

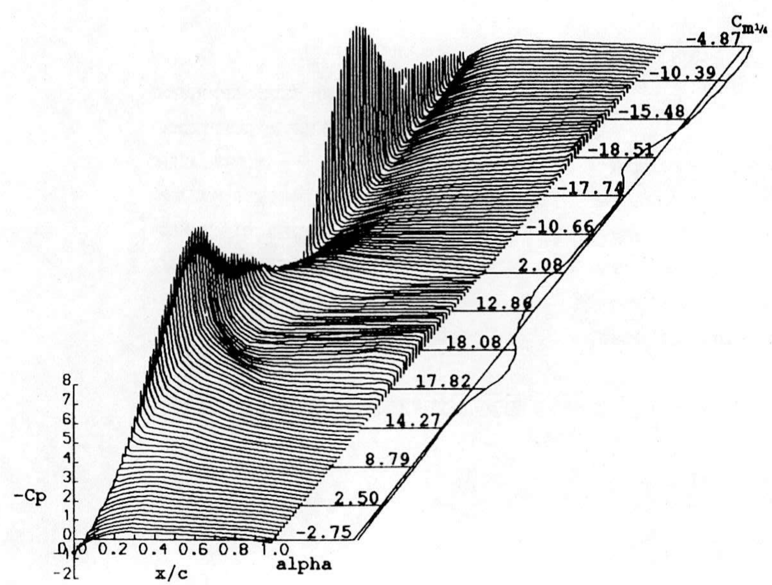
RUN REFERENCE NUMBER: 15201	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1467012.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.82 Nm^{-2}	AIR TEMPERATURE = 23.0°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	

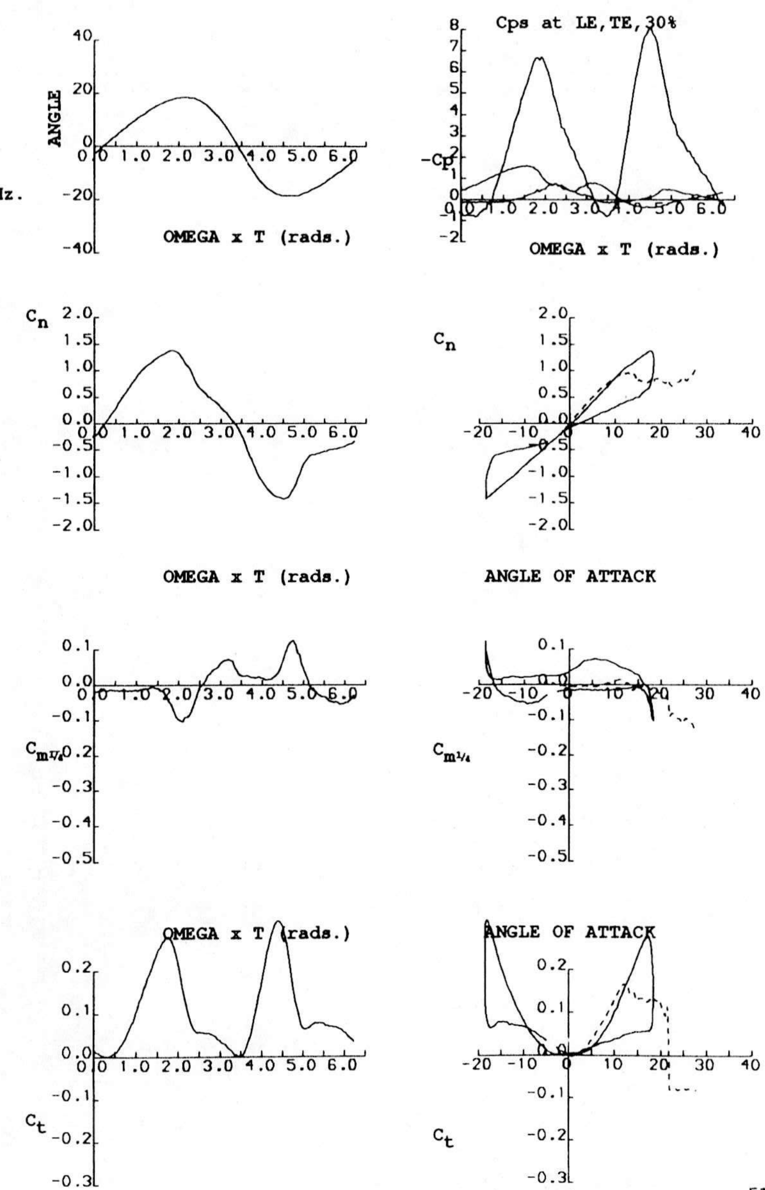




DYNAMIC CHARACTERISTICS FOR THE GUVA10

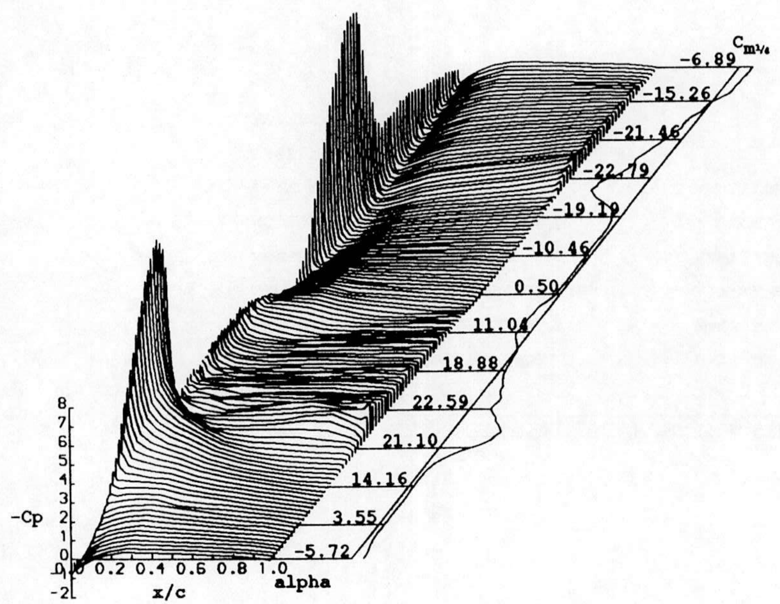
RUN REFERENCE NUMBER: 55131	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1455194.	MACH NUMBER = 0.116
DYNAMIC PRESSURE = 949.82 Nm^{-2}	AIR TEMPERATURE = 22.7°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	

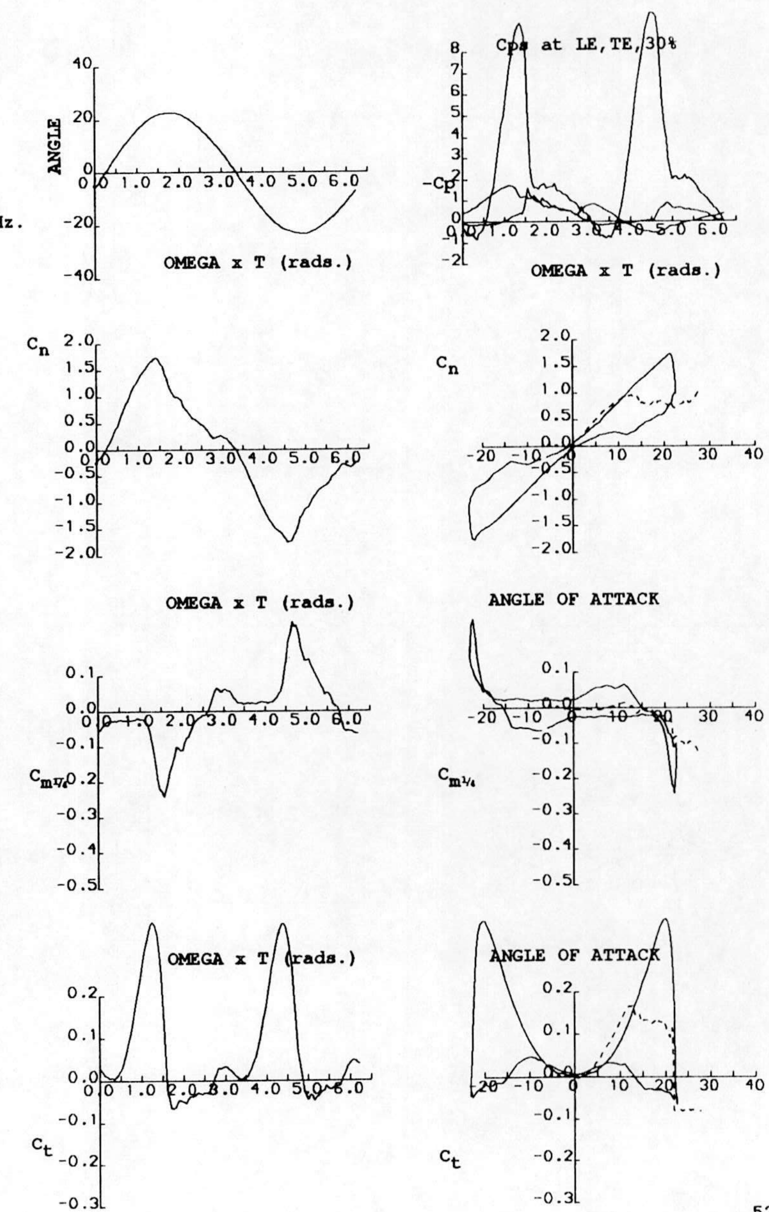




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15211	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1465741.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.82 Nm^{-2}	AIR TEMPERATURE = 23.2°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 22.60°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55141

REYNOLDS NUMBER = 1454563.

DYNAMIC PRESSURE = 949.82 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.463 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

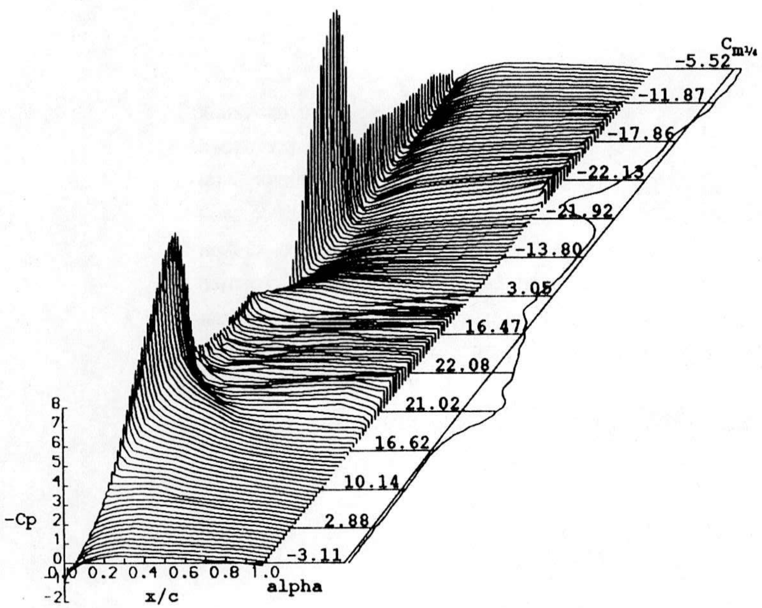
MACH NUMBER = 0.116

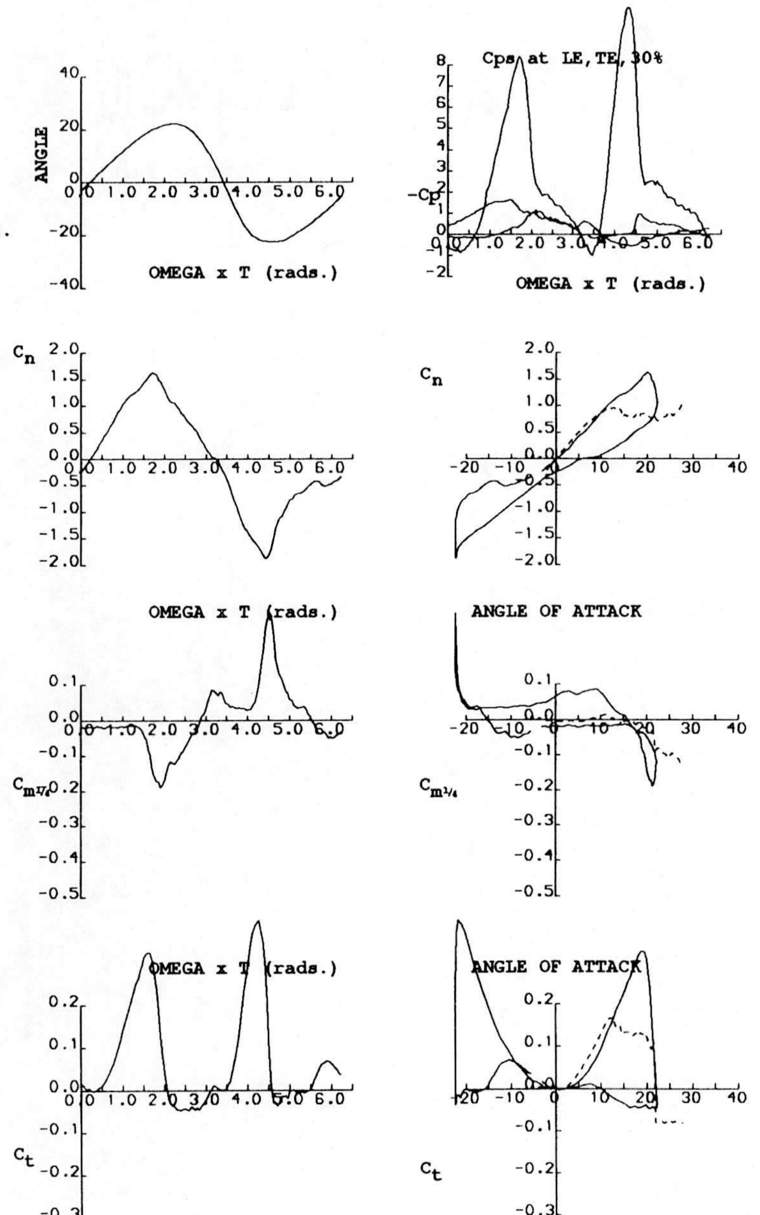
AIR TEMPERATURE = 22.8°C

SAMPLING FREQUENCY = 187.27 Hz.

REDUCED FREQUENCY = 0.063

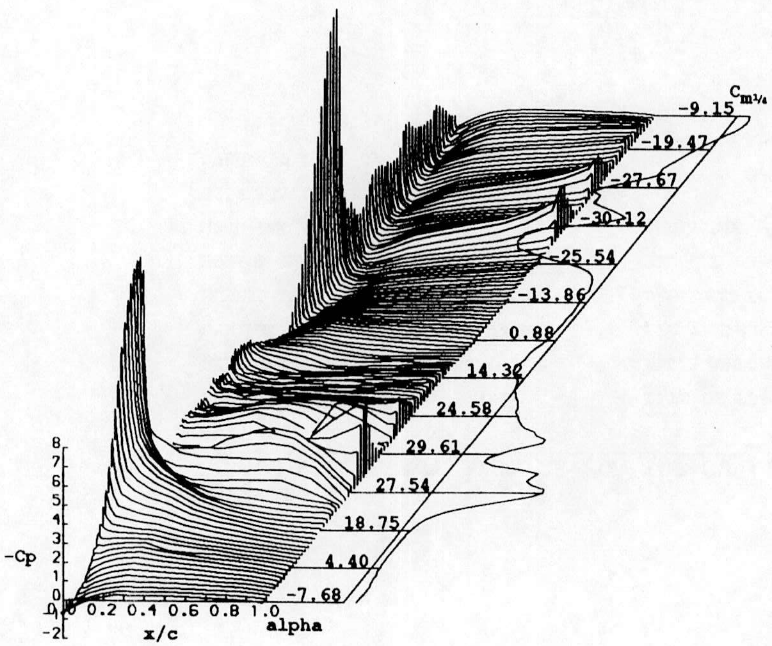
AMPLITUDE = 22.60°

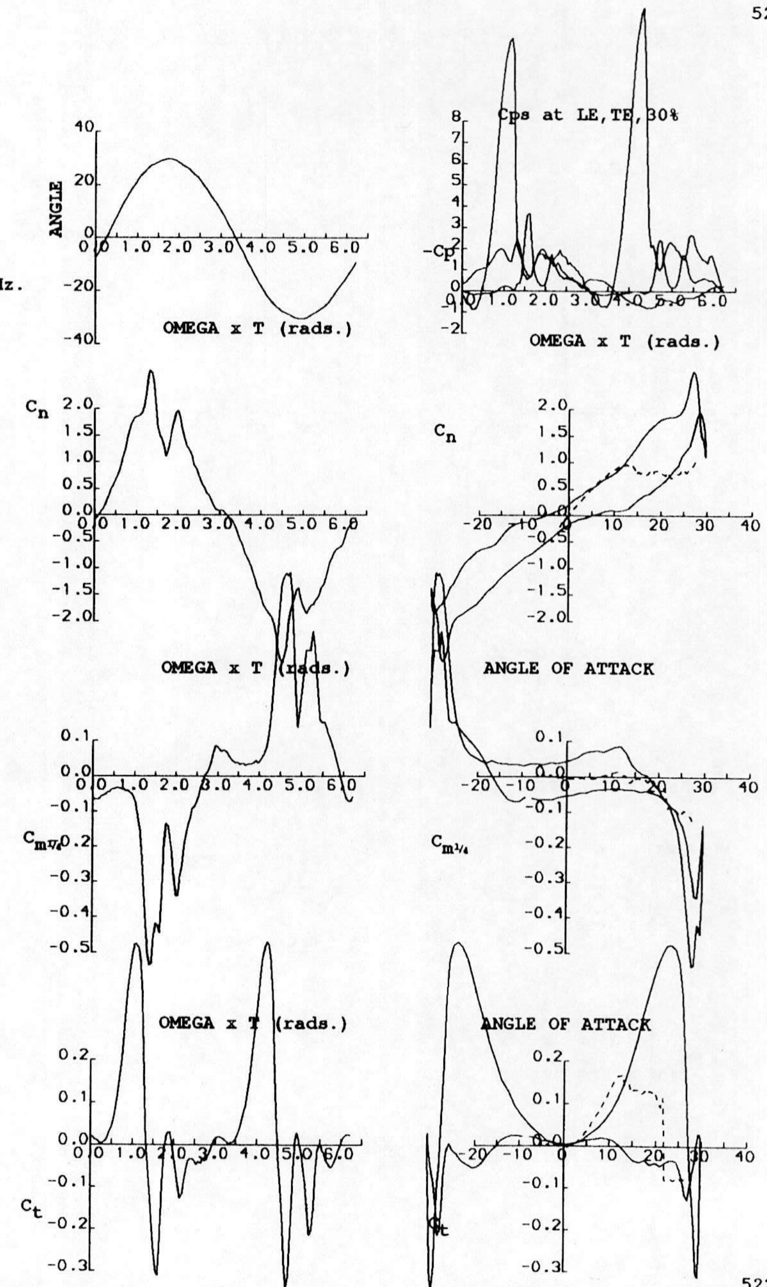




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15221	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1465107.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 967.82 Nm^{-2}	AIR TEMPERATURE = 23.3°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.27 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.063
MEAN ANGLE = 0.00°	AMPLITUDE = 30.00°
OSCILLATION FREQUENCY = 1.463 Hz.	
AVERAGED DATA OF 10 CYCLES	

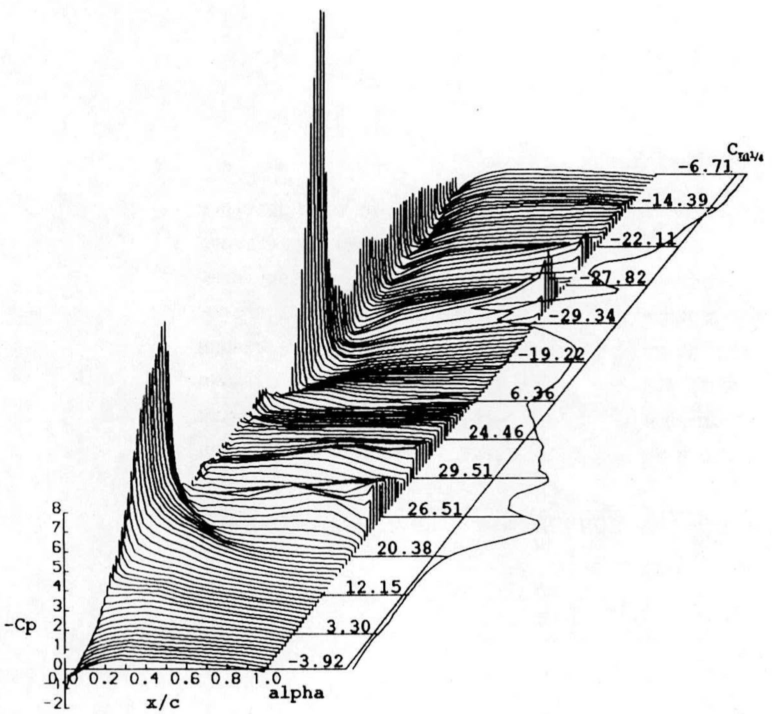


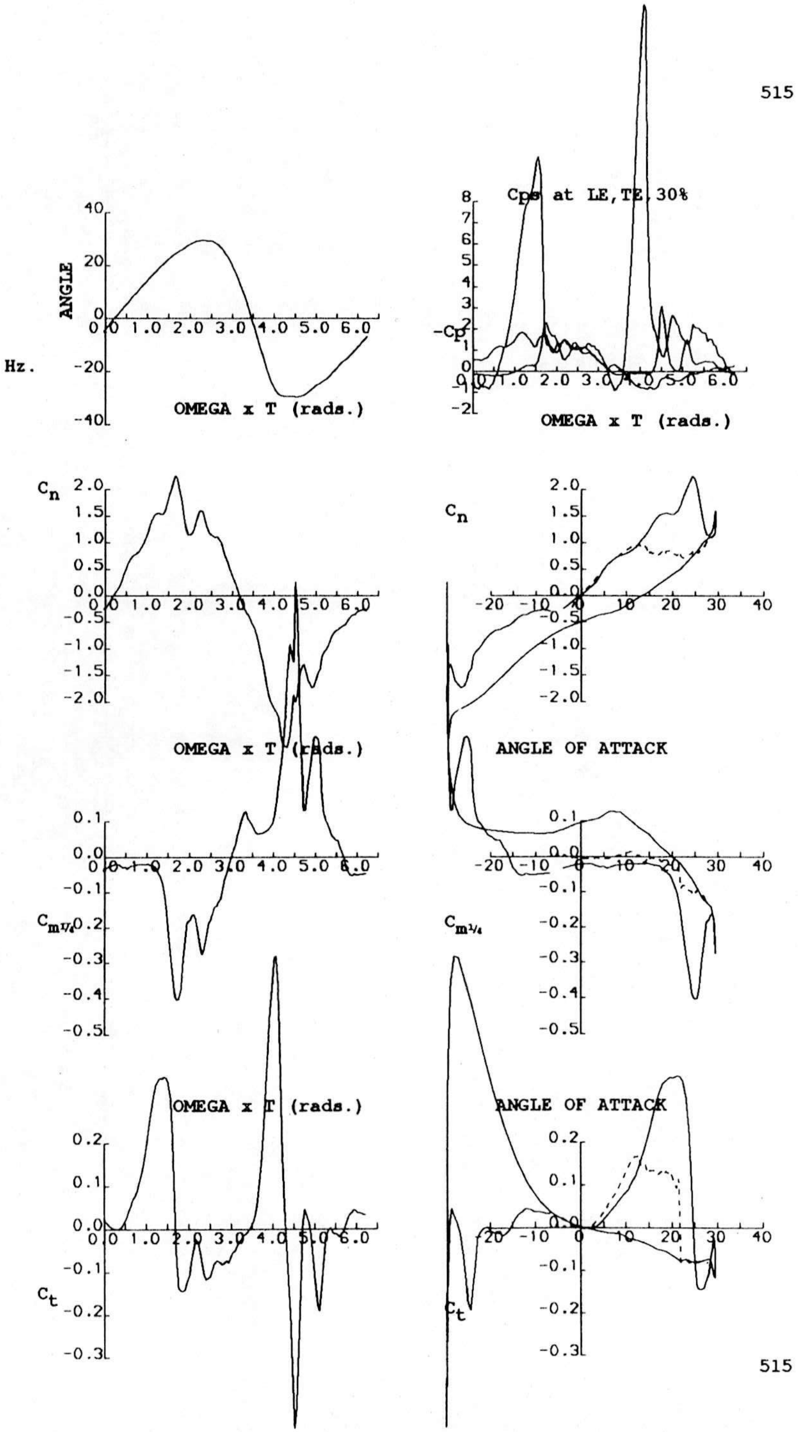


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55151
REYNOLDS NUMBER = 1453303.
DYNAMIC PRESSURE = 949.82 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.463 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.116
AIR TEMPERATURE = 23.0°C
SAMPLING FREQUENCY = 187.27 Hz.
REDUCED FREQUENCY = 0.063
AMPLITUDE = 30.00°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15231

REYNOLDS NUMBER = 1462014.

DYNAMIC PRESSURE = 965.85 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

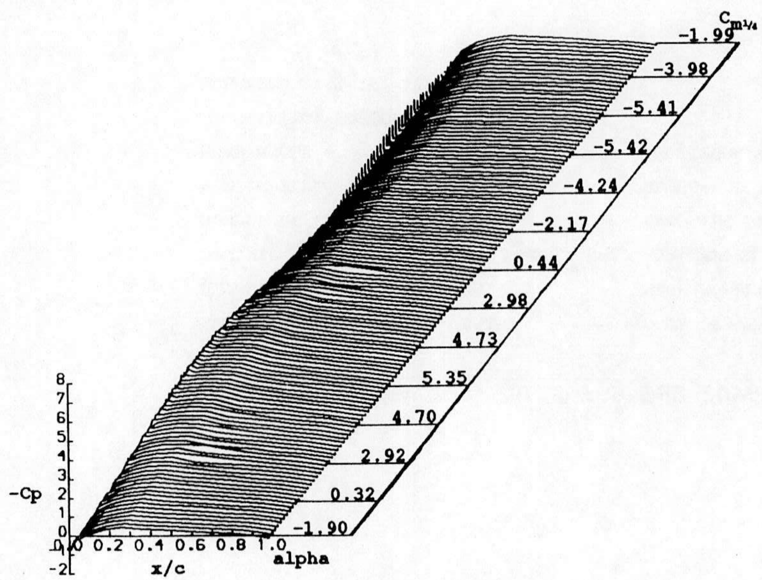
MACH NUMBER = 0.117

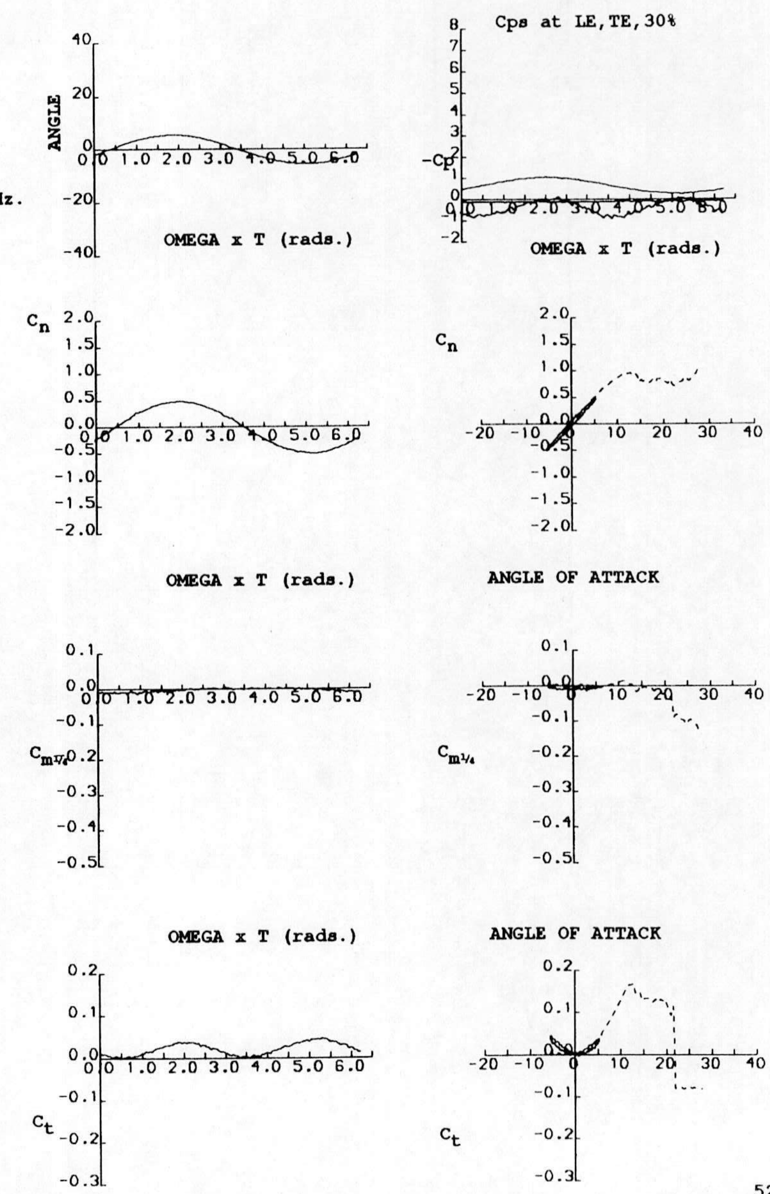
AIR TEMPERATURE = 23.4°C

SAMPLING FREQUENCY = 239.98 Hz.

REDUCED FREQUENCY = 0.080

AMPLITUDE = 5.40°

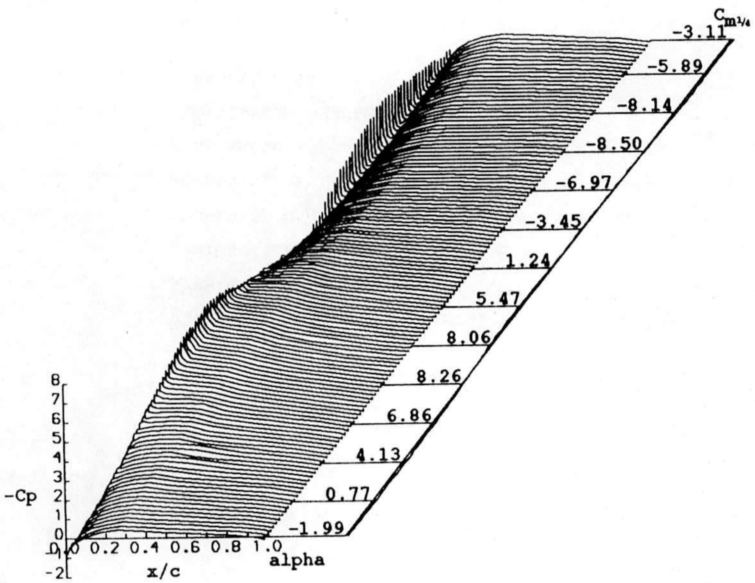


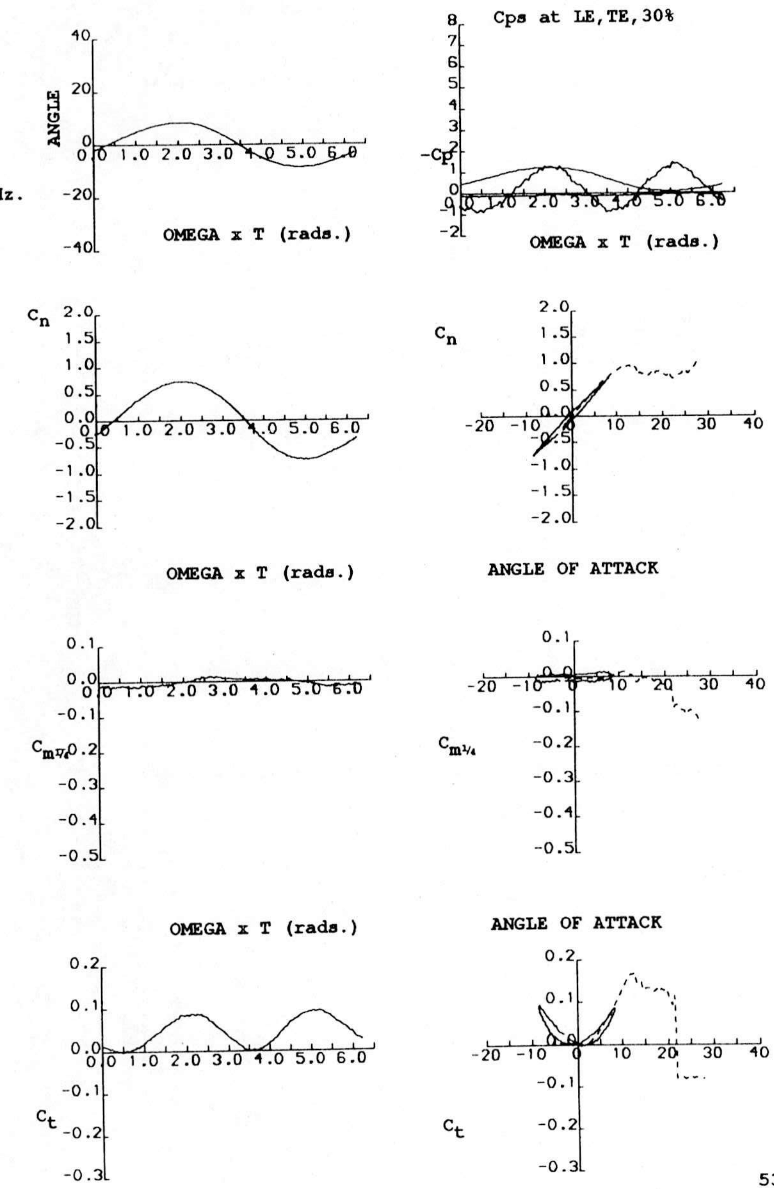


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55301
REYNOLDS NUMBER = 1447429.
DYNAMIC PRESSURE = 945.86 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.116
AIR TEMPERATURE = 23.3°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.081
AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15241

REYNOLDS NUMBER = 1460750.

DYNAMIC PRESSURE = 965.85 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

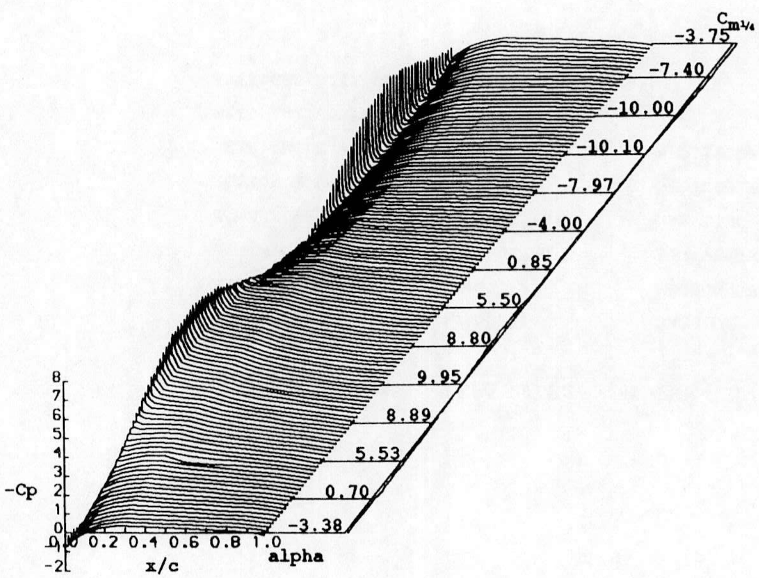
MACH NUMBER = 0.117

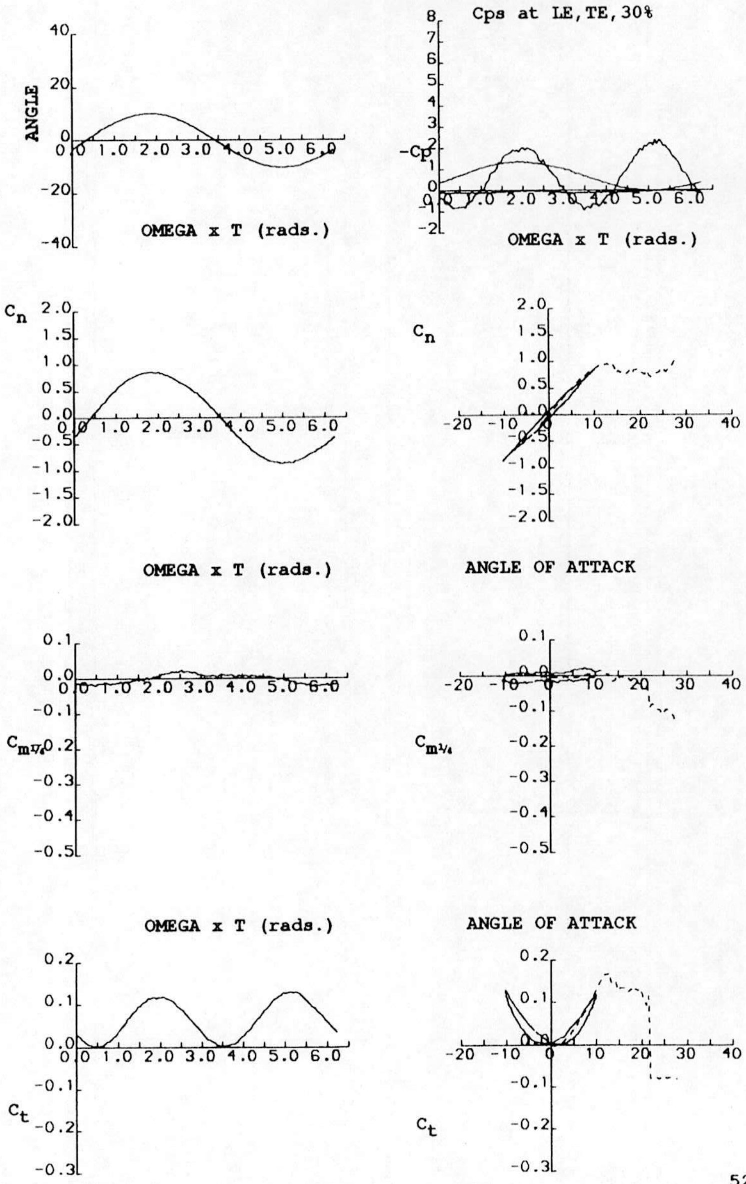
AIR TEMPERATURE = 23.6°C

SAMPLING FREQUENCY = 239.98 Hz.

REDUCED FREQUENCY = 0.080

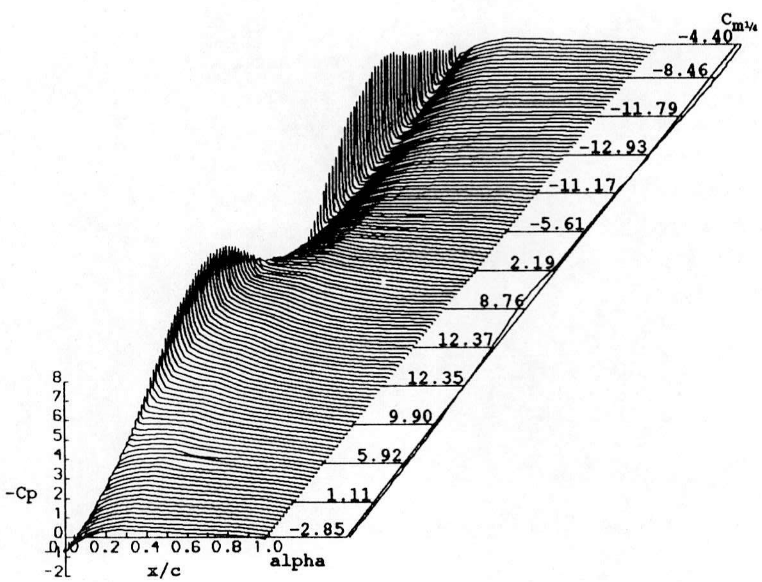
AMPLITUDE = 10.00°

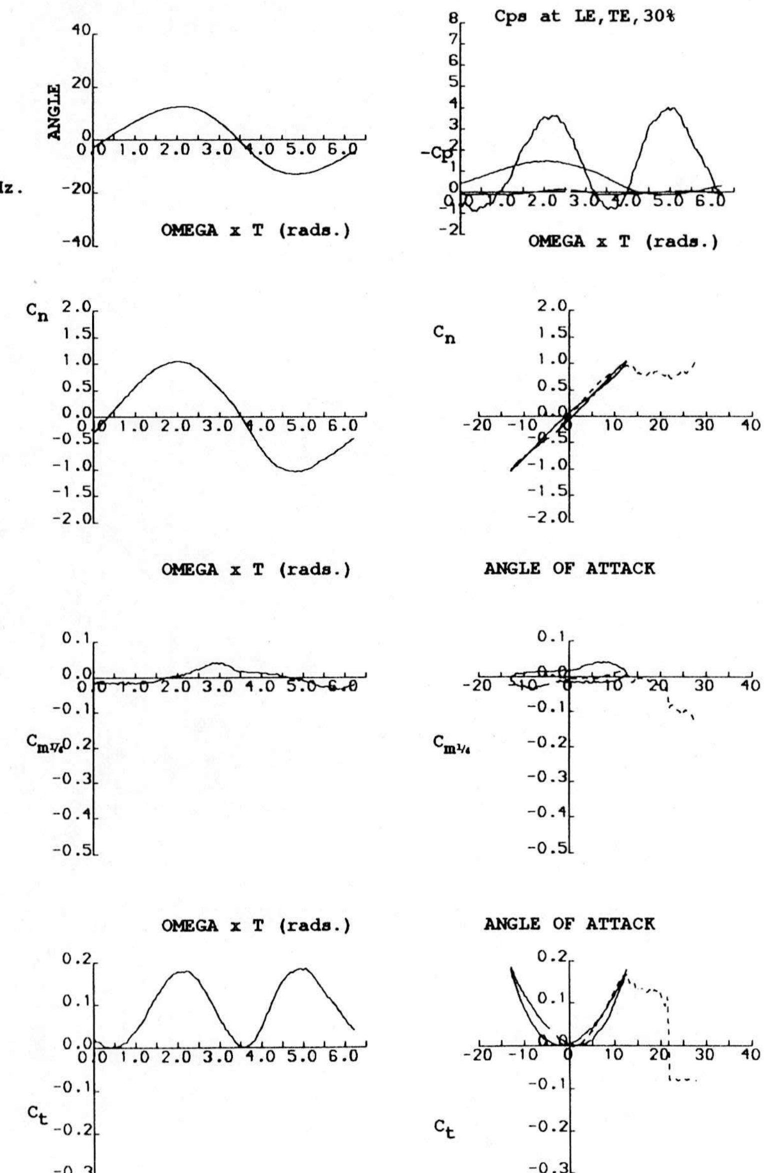




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55311	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1444927.	MACH NUMBER = 0.116
DYNAMIC PRESSURE = 945.86 Nm^{-2}	AIR TEMPERATURE = 23.7°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.081
MEAN ANGLE = 0.00°	AMPLITUDE = 10.00°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	

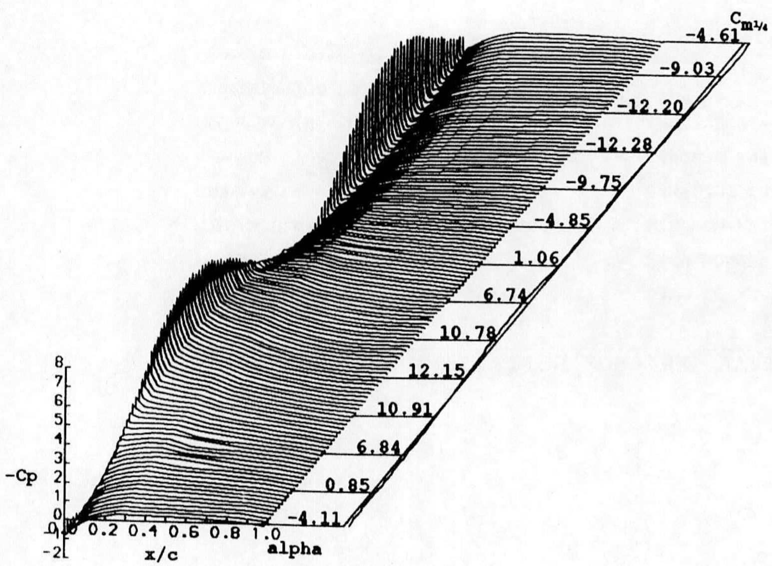


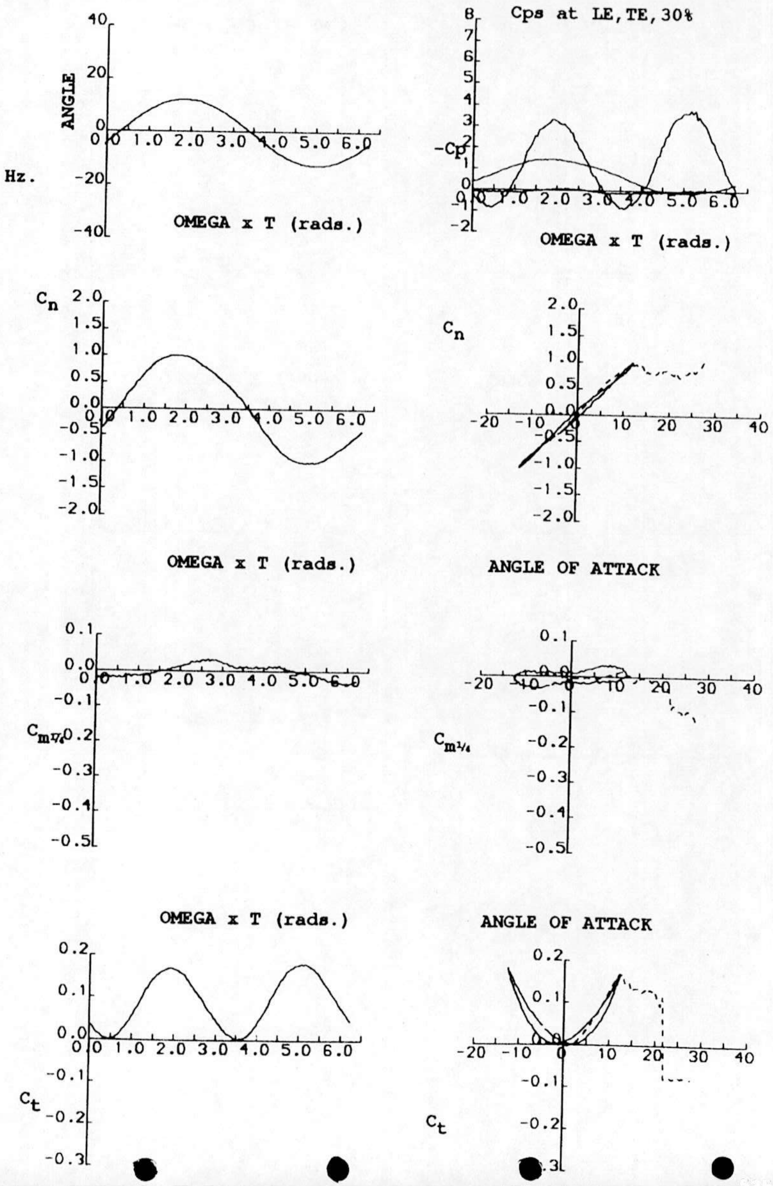


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15251
REYNOLDS NUMBER = 1460119.
DYNAMIC PRESSURE = 965.85 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.7°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.080
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55321

REYNOLDS NUMBER = 1443057.

DYNAMIC PRESSURE = 945.86 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

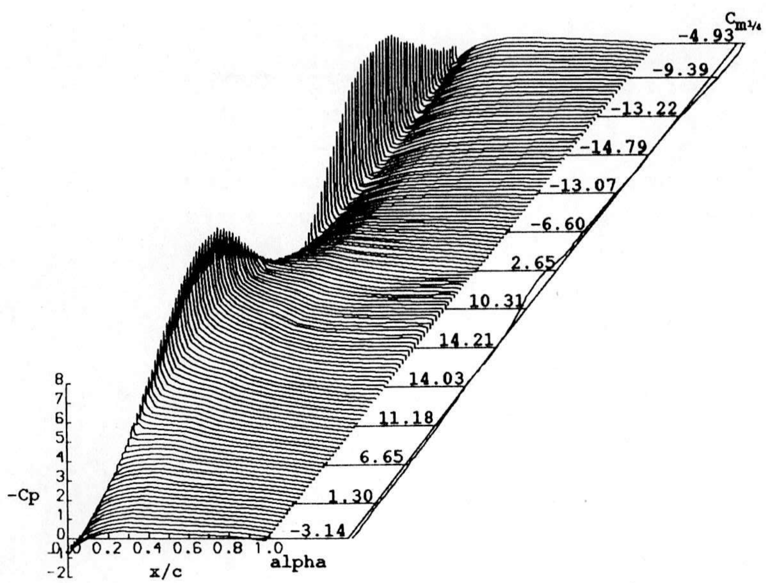
MACH NUMBER = 0.116

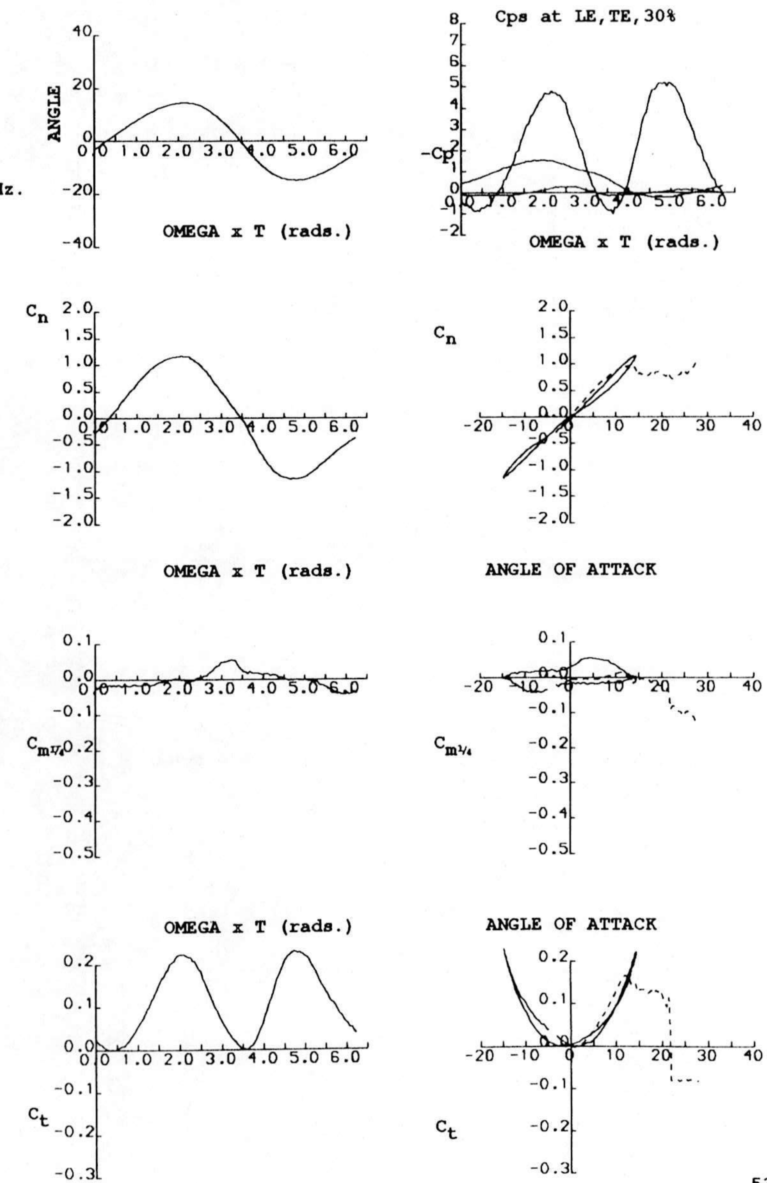
AIR TEMPERATURE = 24.0°C

SAMPLING FREQUENCY = 239.98 Hz.

REDUCED FREQUENCY = 0.081

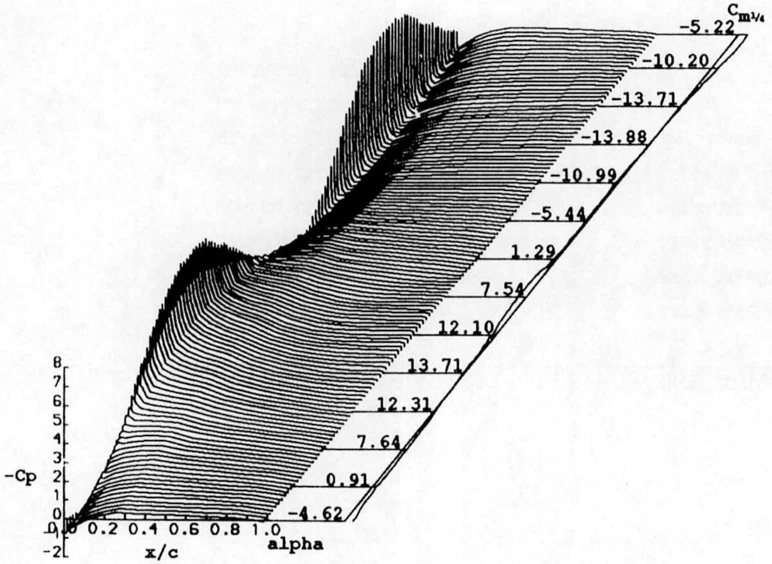
AMPLITUDE = 12.20°

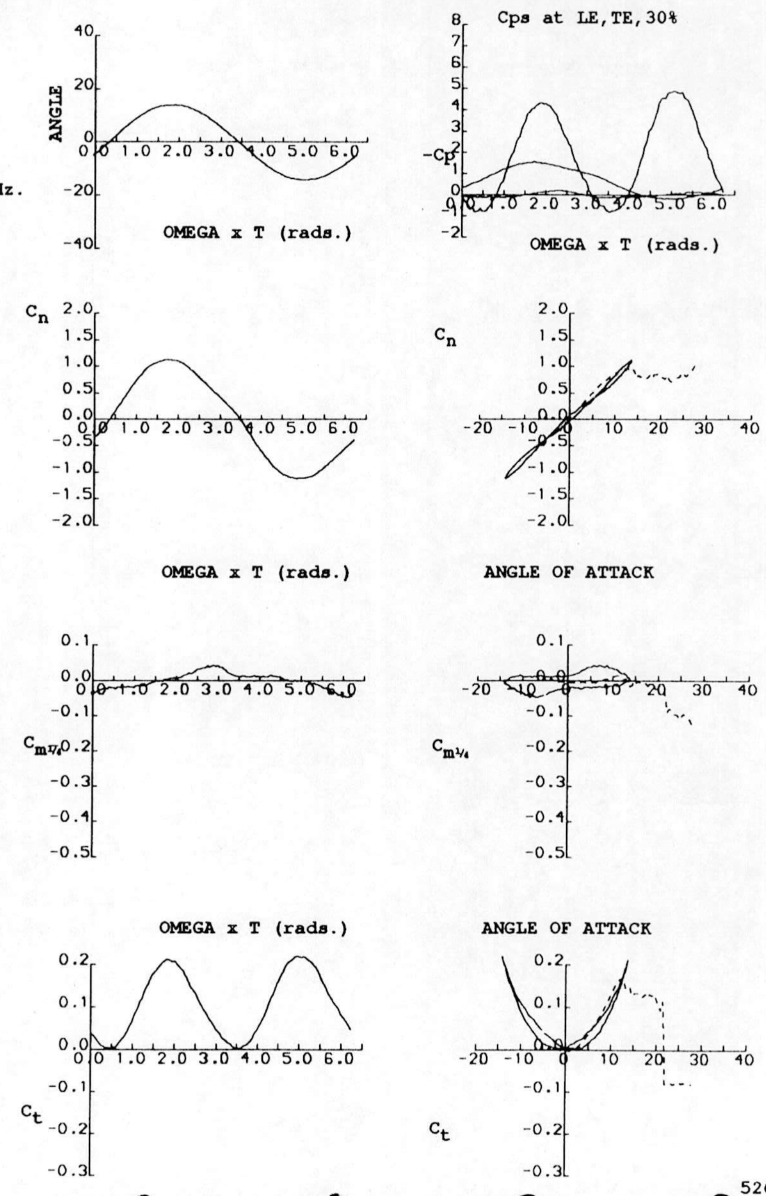




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15261	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1459488.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 965.85 Nm^{-2}	AIR TEMPERATURE = 23.8°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.080
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	

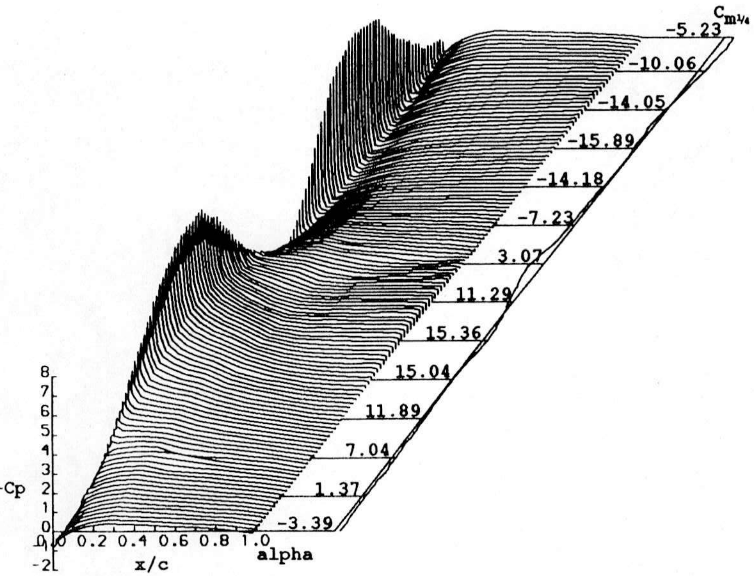


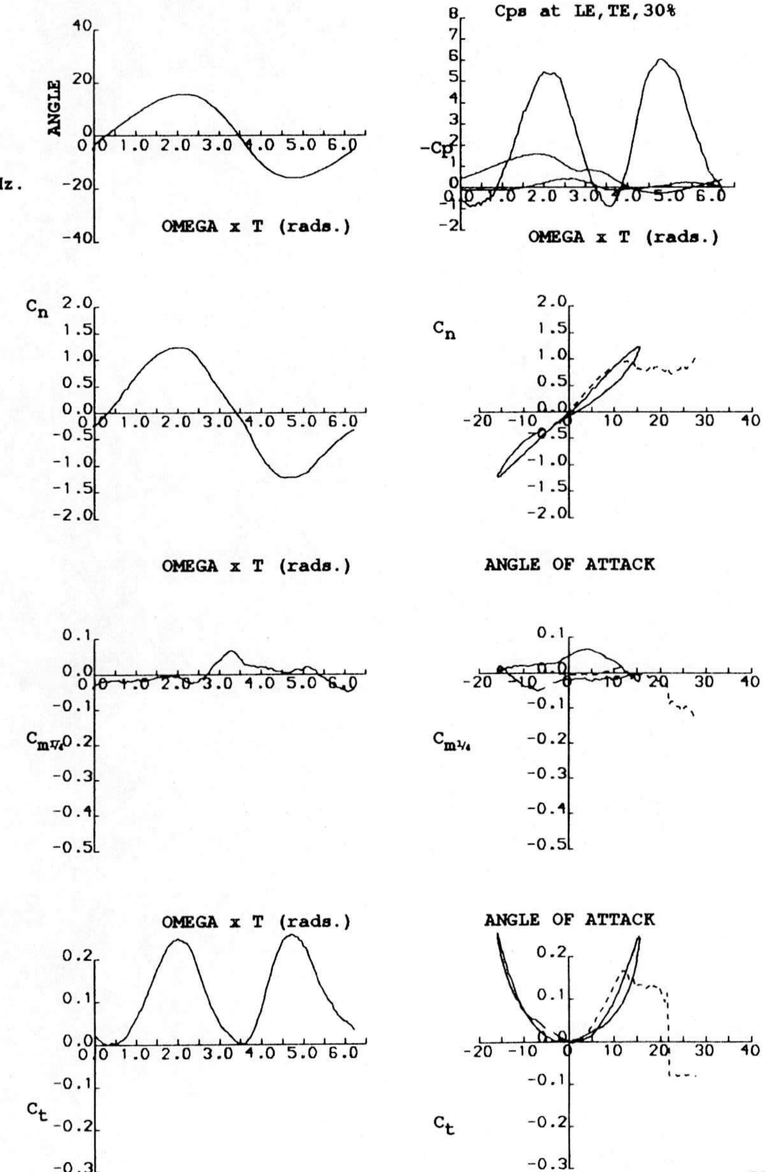


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55331
REYNOLDS NUMBER = 1441812.
DYNAMIC PRESSURE = 945.86 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.116
AIR TEMPERATURE = 24.2°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.081
AMPLITUDE = 13.80°

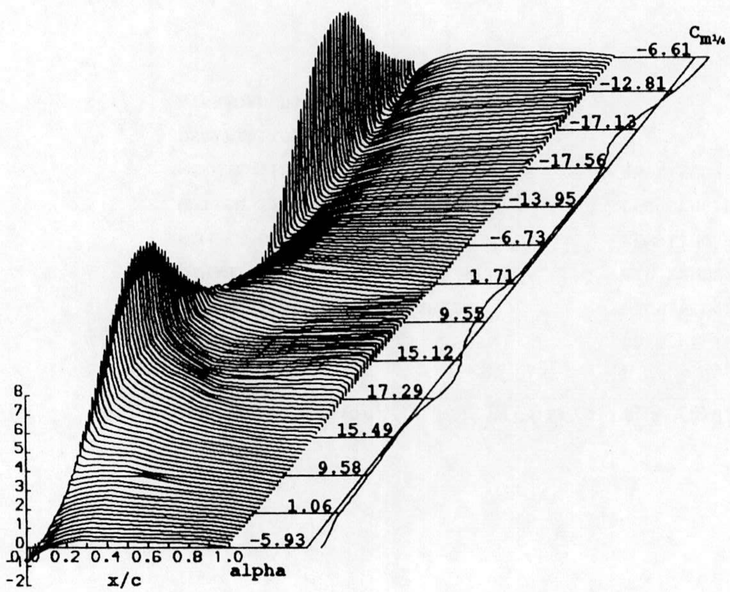


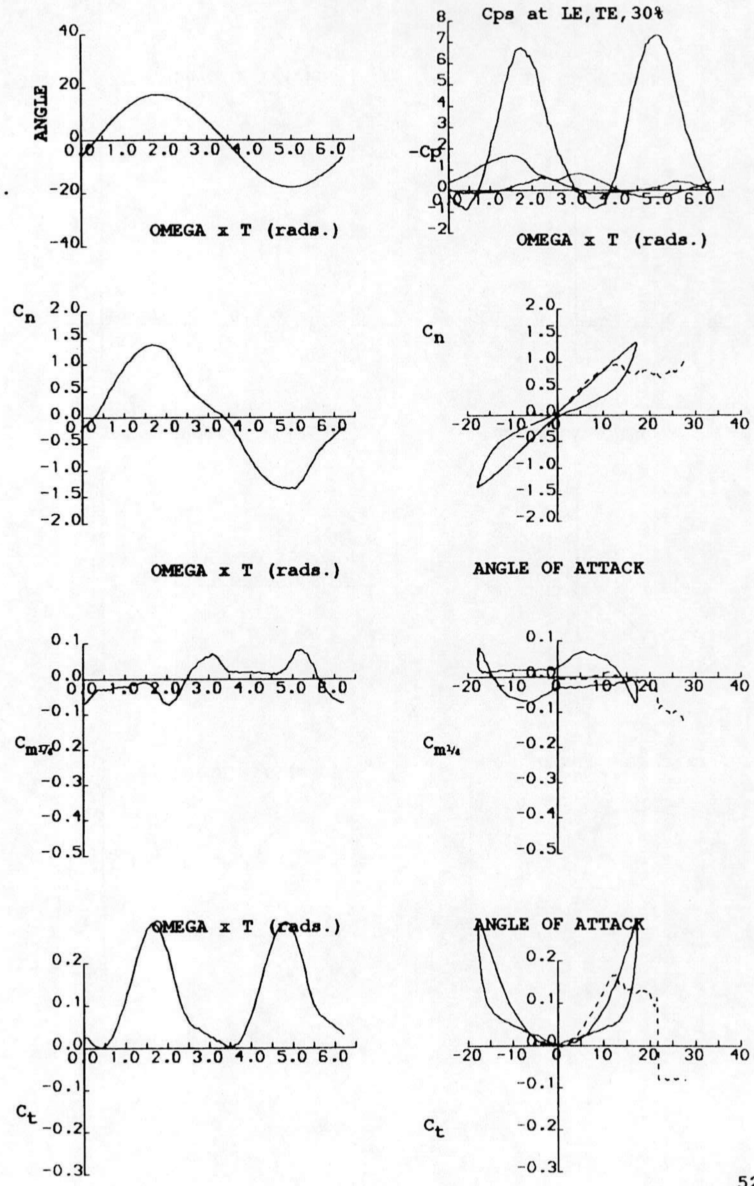


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15271
REYNOLDS NUMBER = 1458858.
DYNAMIC PRESSURE = 965.85 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

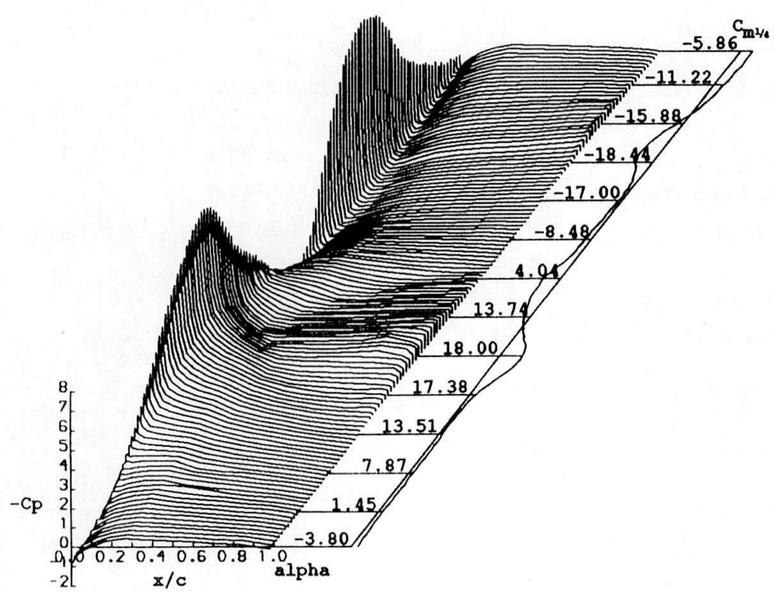
DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.080
AMPLITUDE = 17.40°

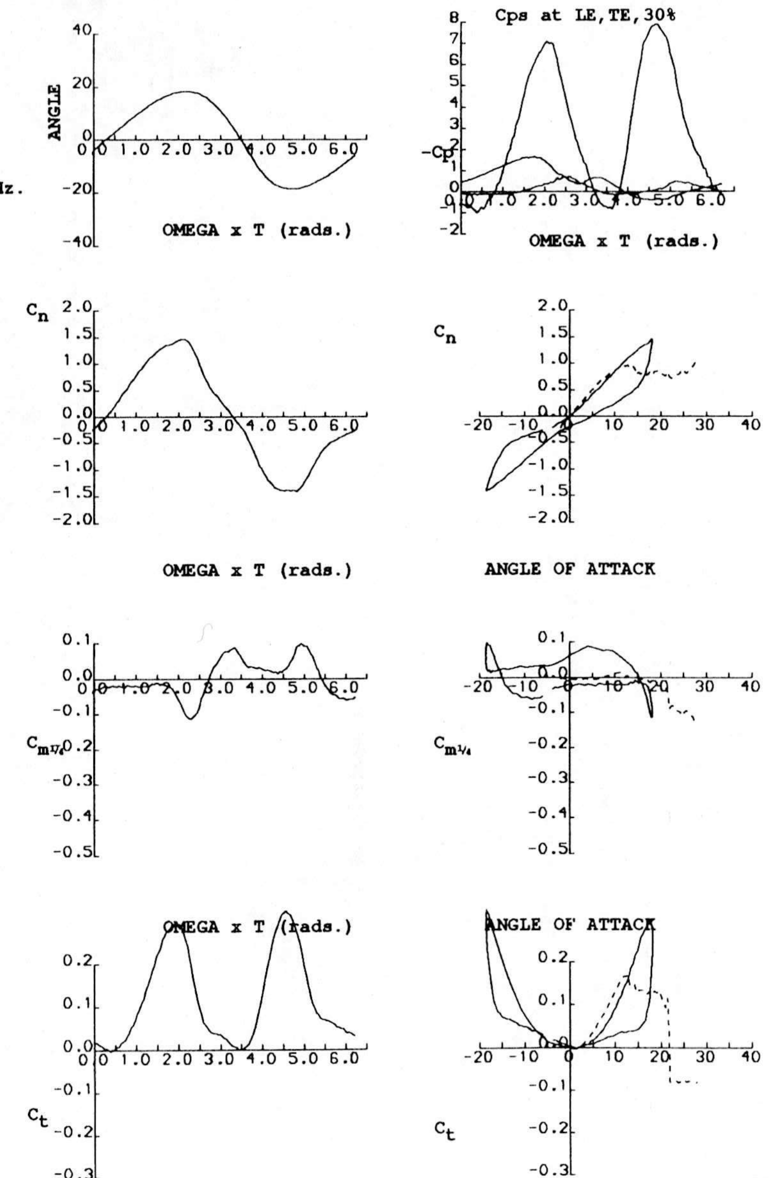




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55341	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1441191.	MACH NUMBER = 0.116
DYNAMIC PRESSURE = 945.86 Nm^{-2}	AIR TEMPERATURE = 24.3°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.081
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	

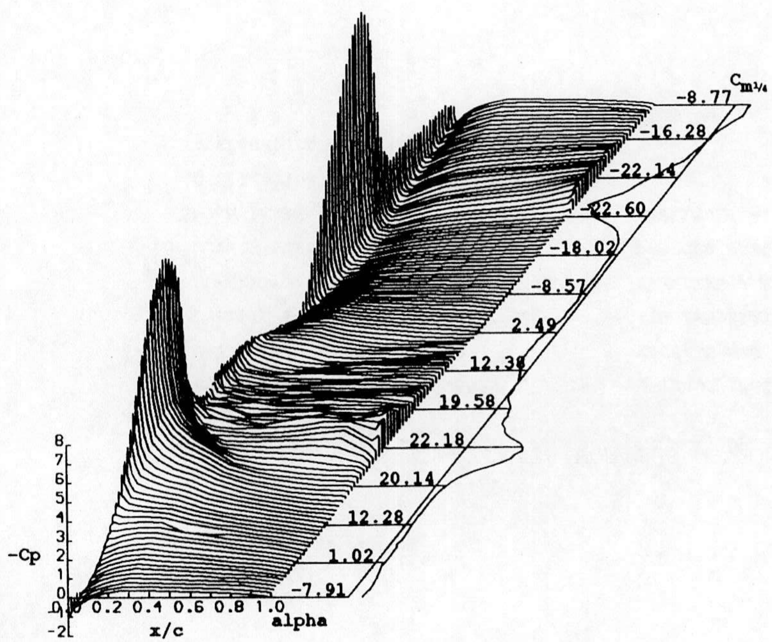


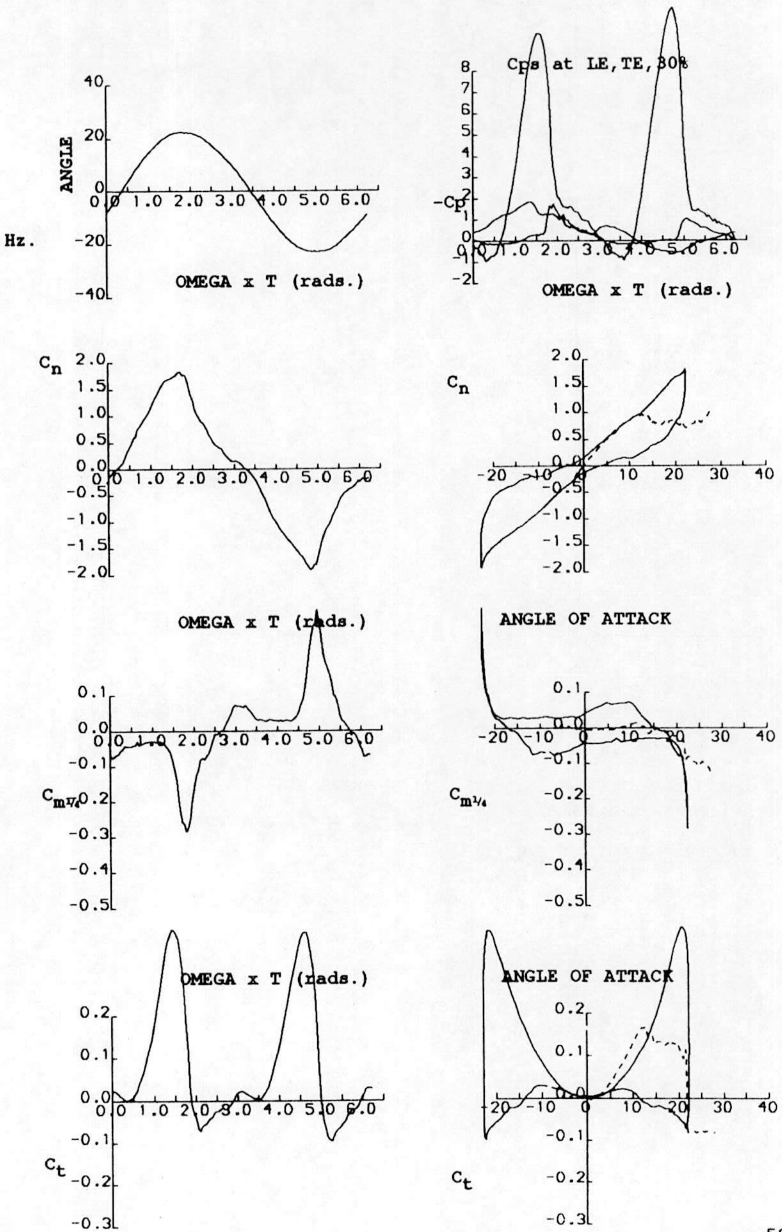


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15281
REYNOLDS NUMBER = 1458228.
DYNAMIC PRESSURE = 965.85 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 24.0°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.080
AMPLITUDE = 22.60°

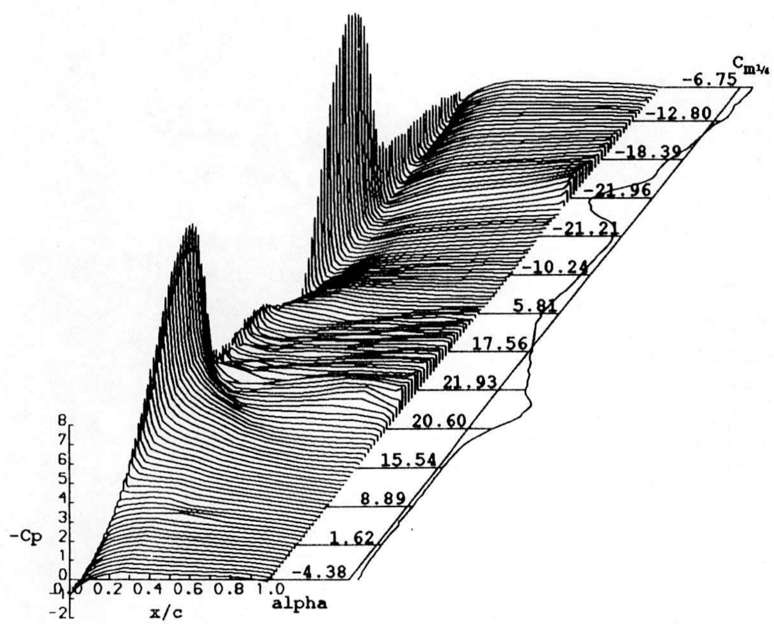


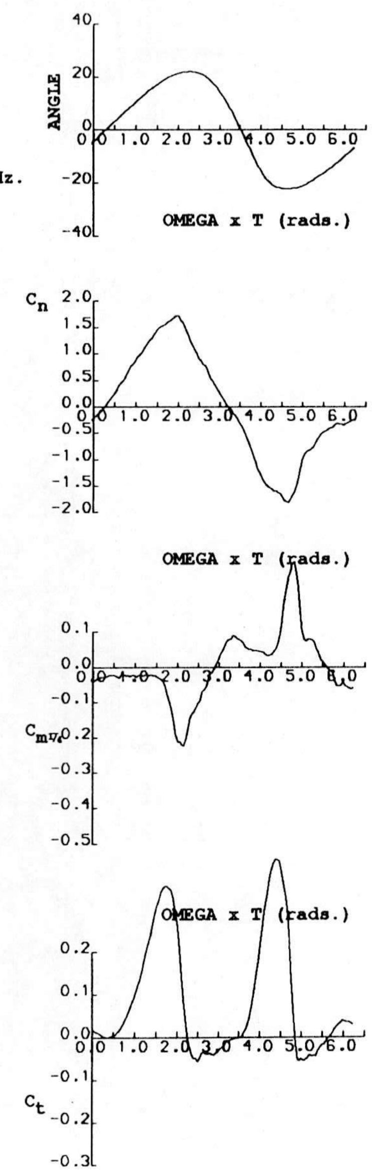


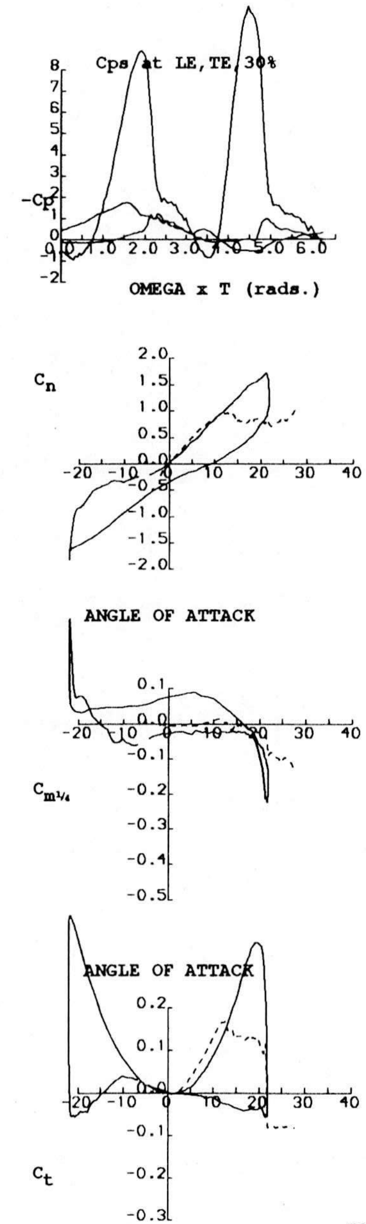
DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55351
REYNOLDS NUMBER = 1439949.
DYNAMIC PRESSURE = 945.86 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92
MACH NUMBER = 0.116
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.081
AMPLITUDE = 22.60°







DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 15291

REYNOLDS NUMBER = 1456971.

DYNAMIC PRESSURE = 965.85 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 5/3/92

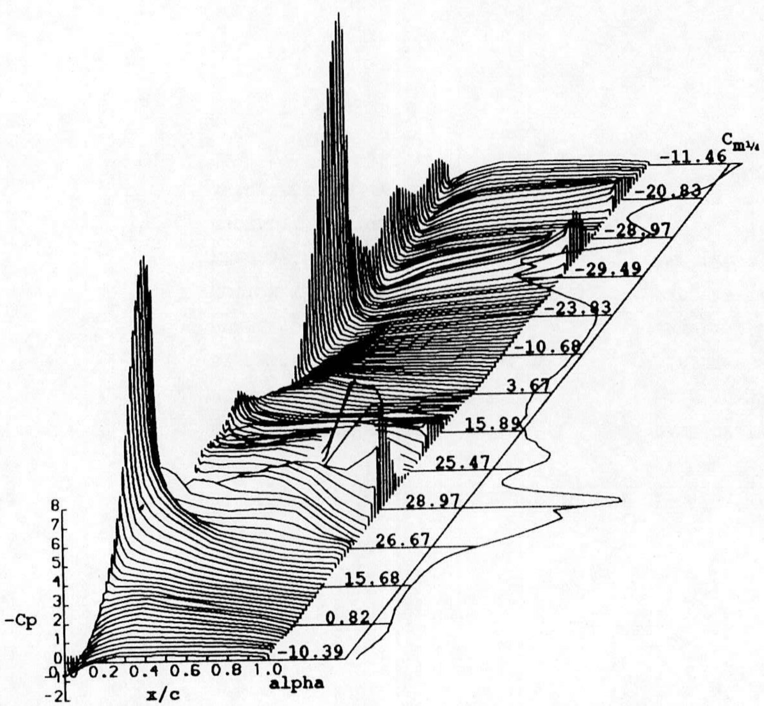
MACH NUMBER = 0.117

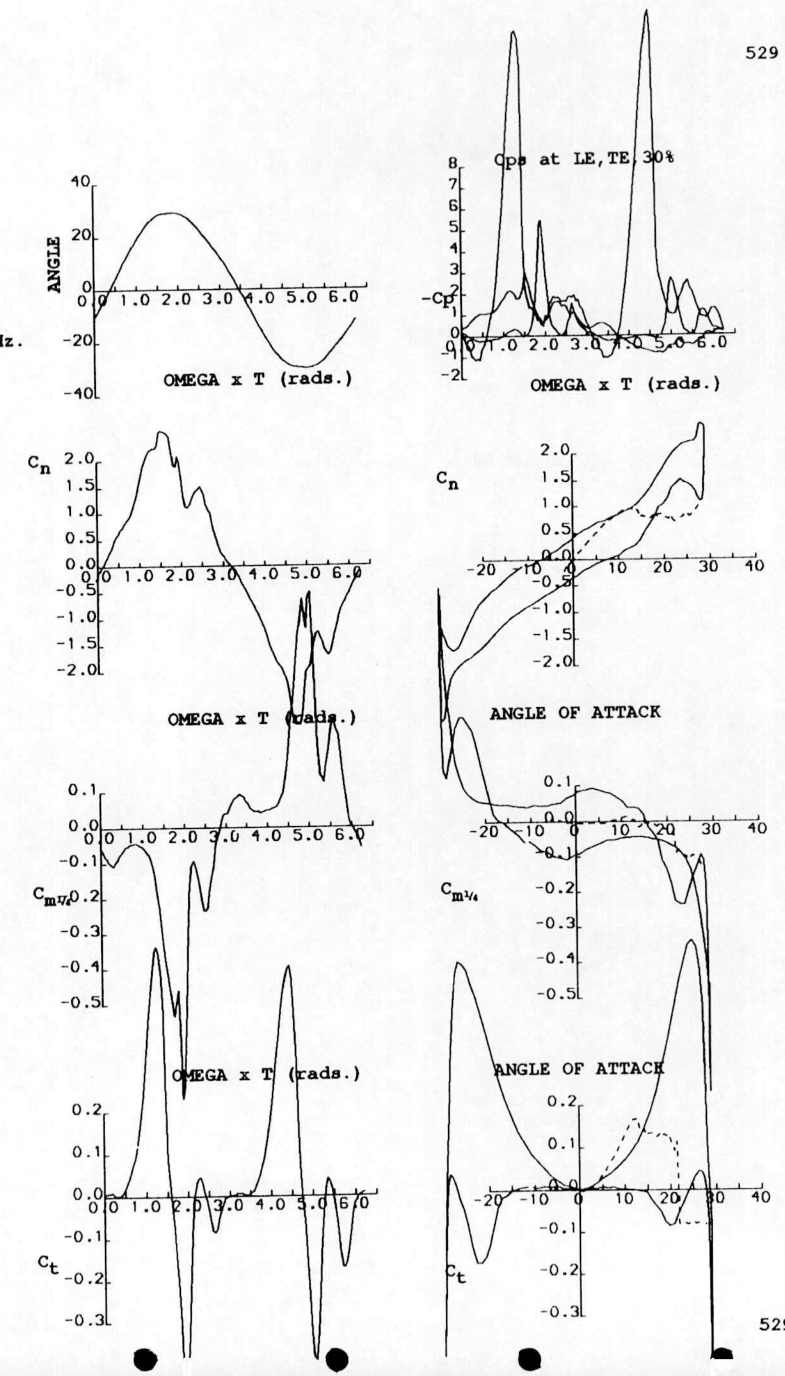
AIR TEMPERATURE = 24.2°C

SAMPLING FREQUENCY = 239.98 Hz.

REDUCED FREQUENCY = 0.080

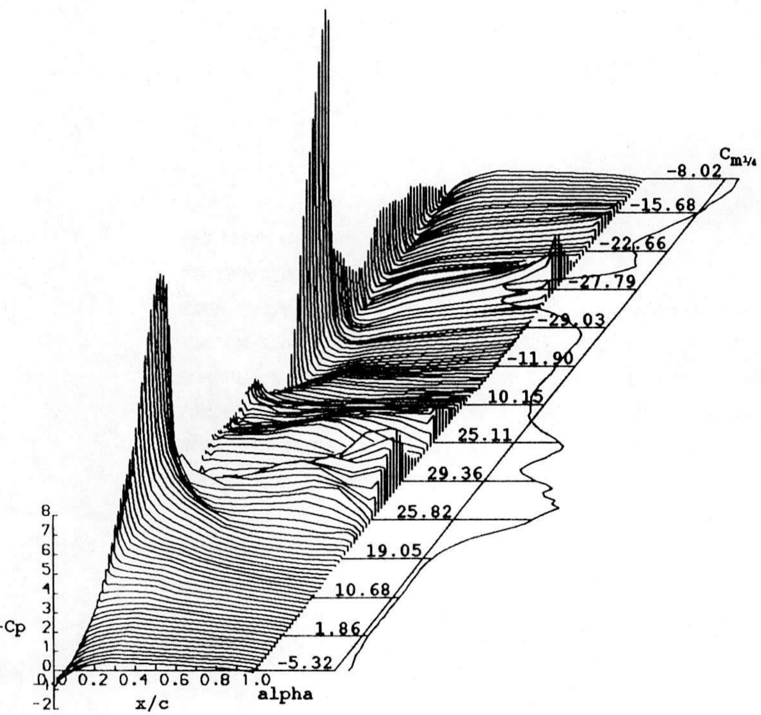
AMPLITUDE = 30.00°

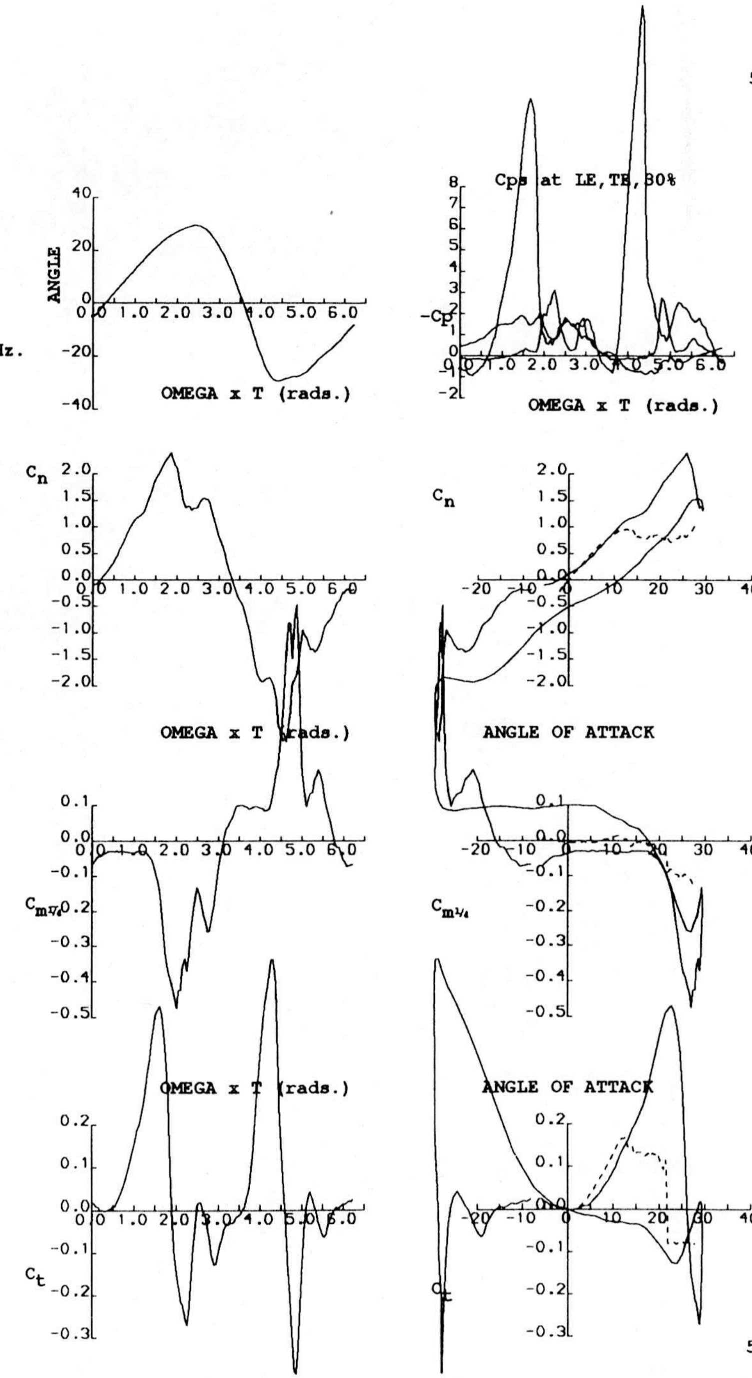




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 55361	DATE OF TEST: 5/3/92
REYNOLDS NUMBER = 1439329.	MACH NUMBER = 0.116
DYNAMIC PRESSURE = 945.86 Nm^{-2}	AIR TEMPERATURE = 24.6°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.081
MEAN ANGLE = 0.00°	AMPLITUDE = 30.00°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815501

DATE OF TEST: 9/3/92

REYNOLDS NUMBER = 1506917.

MACH NUMBER = 0.117

DYNAMIC PRESSURE = 977.94 Nm^{-2}

AIR TEMPERATURE = 19.1°C

NUMBER OF CYCLES = 10

SAMPLING FREQUENCY = 239.98 Hz.

MOTION TYPE: SINUSOIDAL

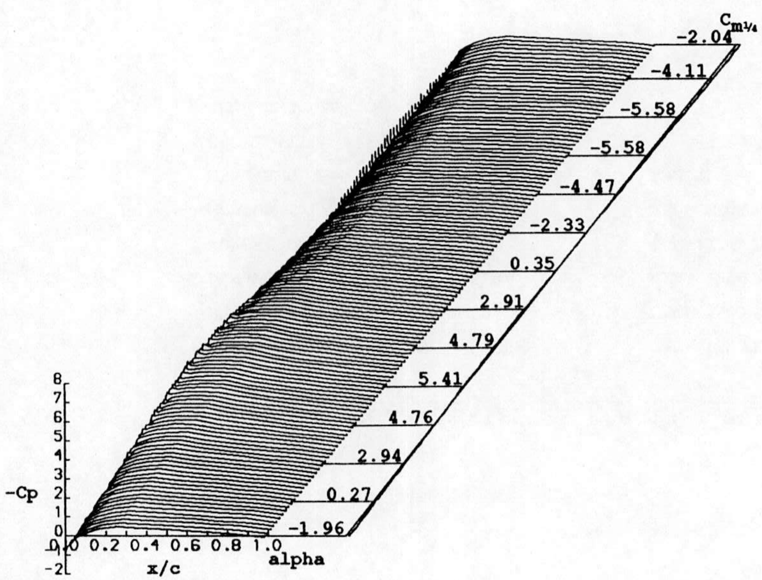
REDUCED FREQUENCY = 0.081

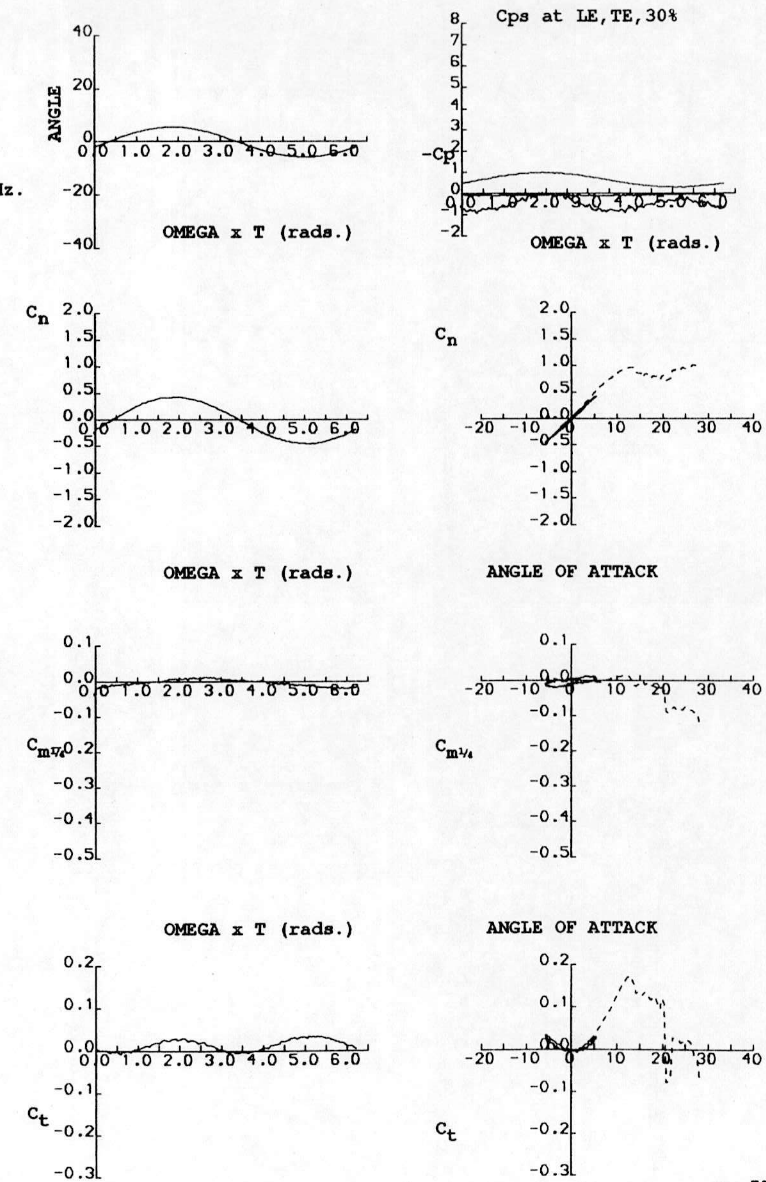
MEAN ANGLE = 0.00°

AMPLITUDE = 5.40°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815511

DATE OF TEST: 9/3/92

REYNOLDS NUMBER = 1504931.

MACH NUMBER = 0.117

DYNAMIC PRESSURE = 977.94 Nm^{-2}

AIR TEMPERATURE = 19.4°C

NUMBER OF CYCLES = 10

SAMPLING FREQUENCY = 239.98 Hz.

MOTION TYPE: SINUSOIDAL

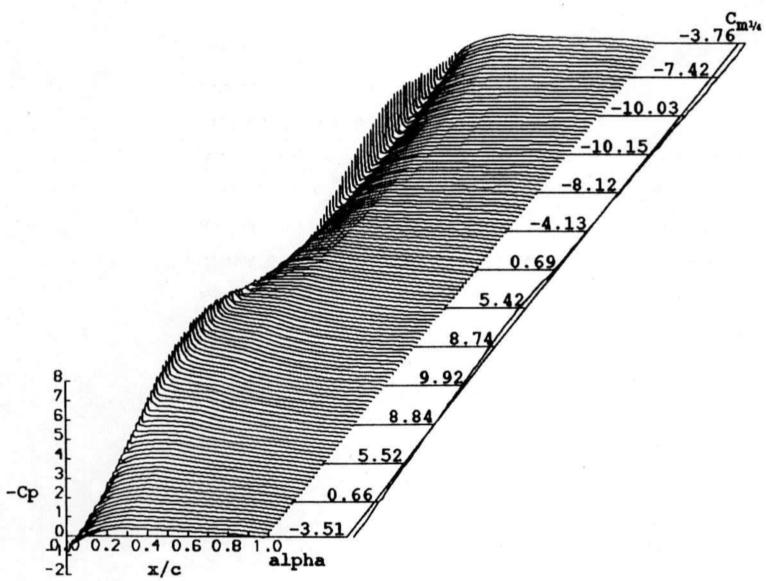
REDUCED FREQUENCY = 0.081

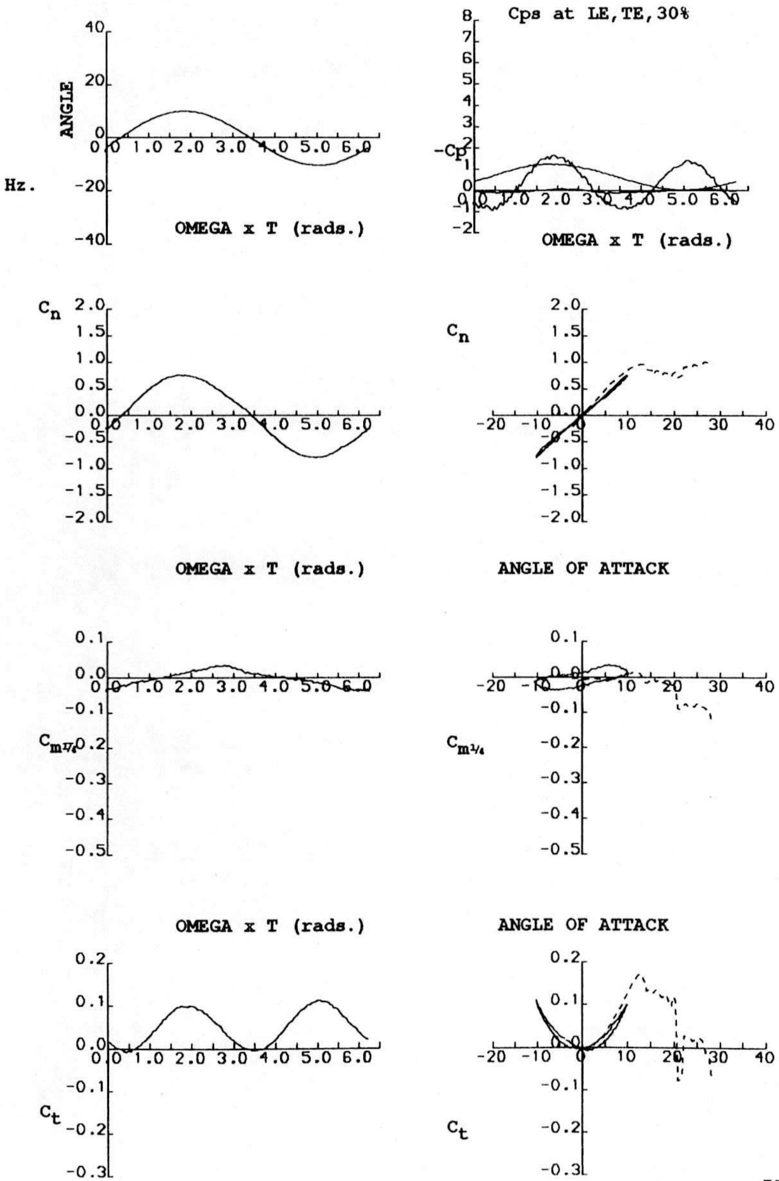
MEAN ANGLE = 0.00°

AMPLITUDE = 10.00°

OSCILLATION FREQUENCY = 1.875 Hz.

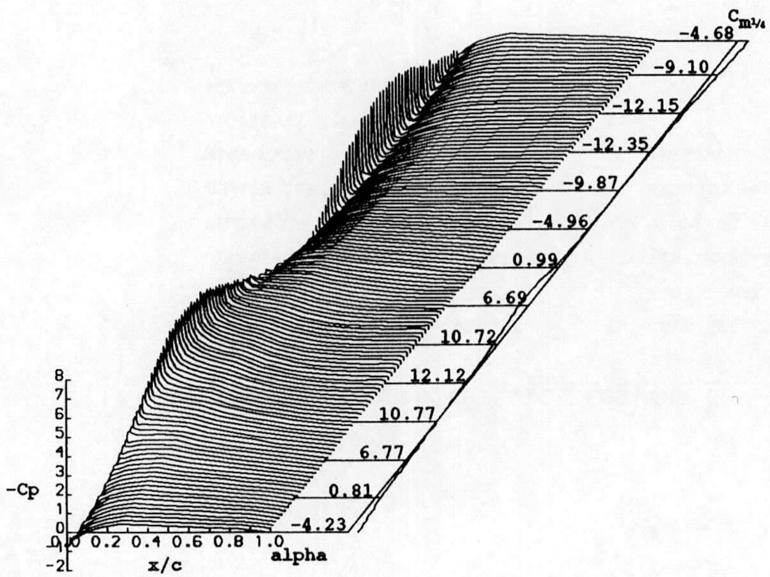
AVERAGED DATA OF 10 CYCLES

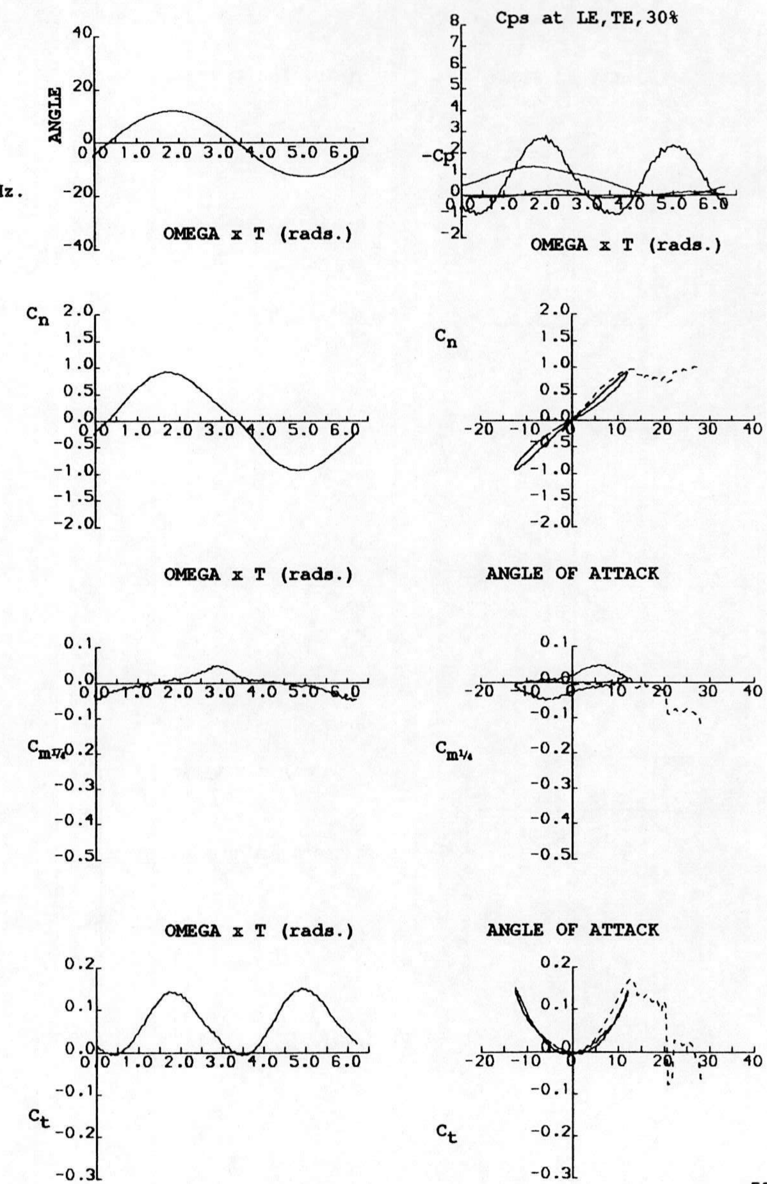




DYNAMIC CHARACTERISTICS FOR THE GUVA10

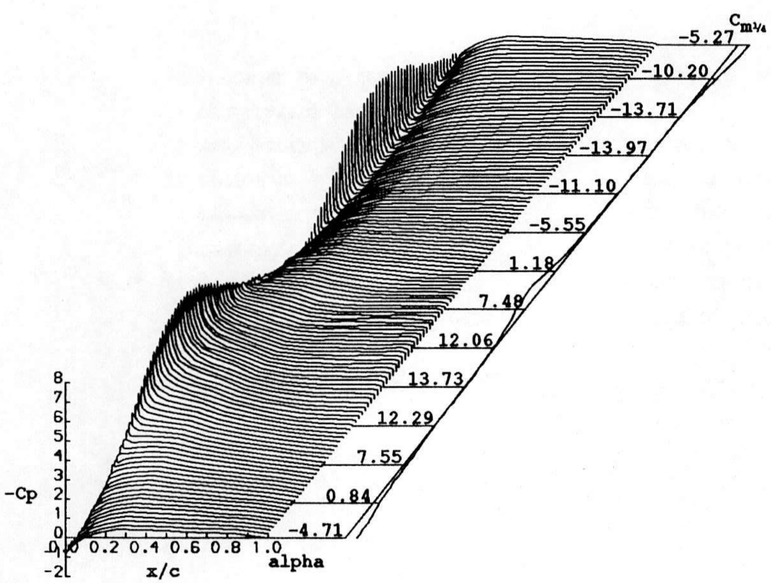
RUN REFERENCE NUMBER: 815521	DATE OF TEST: 9/3/92
REYNOLDS NUMBER = 1503609.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 977.94 Nm^{-2}	AIR TEMPERATURE = 19.6°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.081
MEAN ANGLE = 0.00°	AMPLITUDE = 12.20°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	

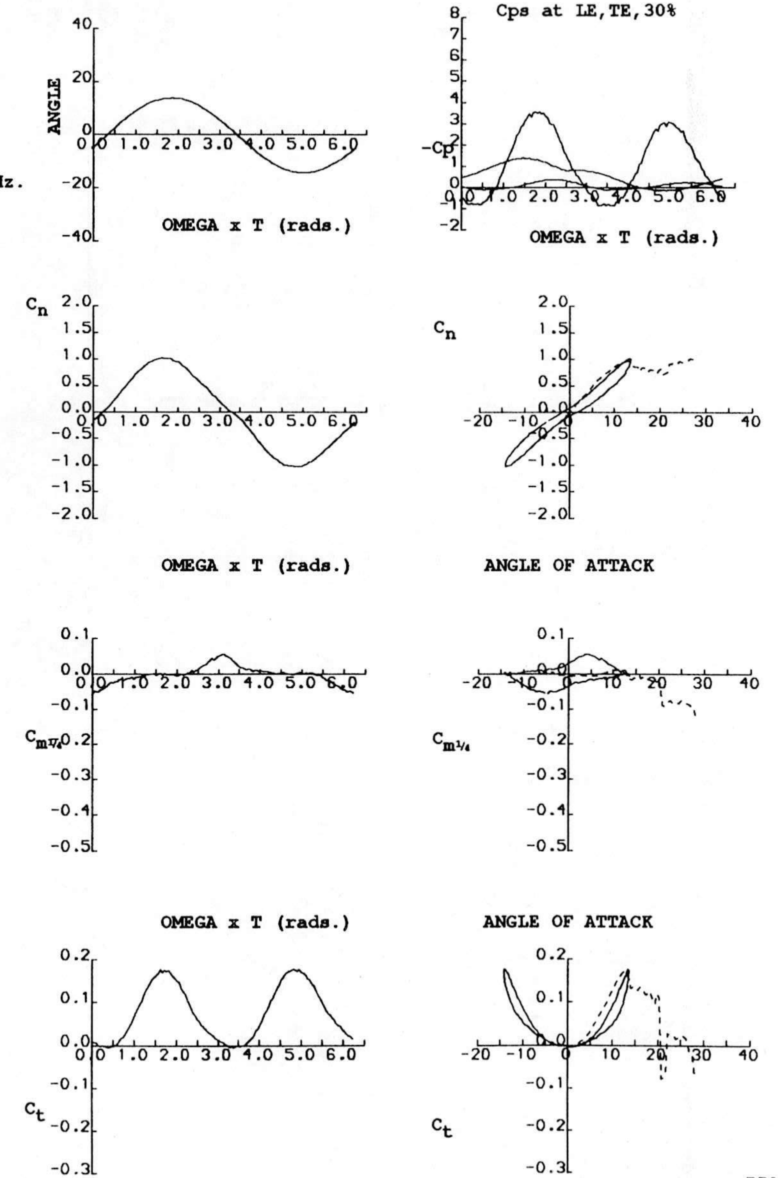




DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815531	DATE OF TEST: 9/3/92
REYNOLDS NUMBER = 1502290.	MACH NUMBER = 0.117
DYNAMIC PRESSURE = 977.94 Nm^{-2}	AIR TEMPERATURE = 19.8°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 239.98 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.081
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 1.875 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815541

REYNOLDS NUMBER = 1500972.

DYNAMIC PRESSURE = 977.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.875 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 9/3/92

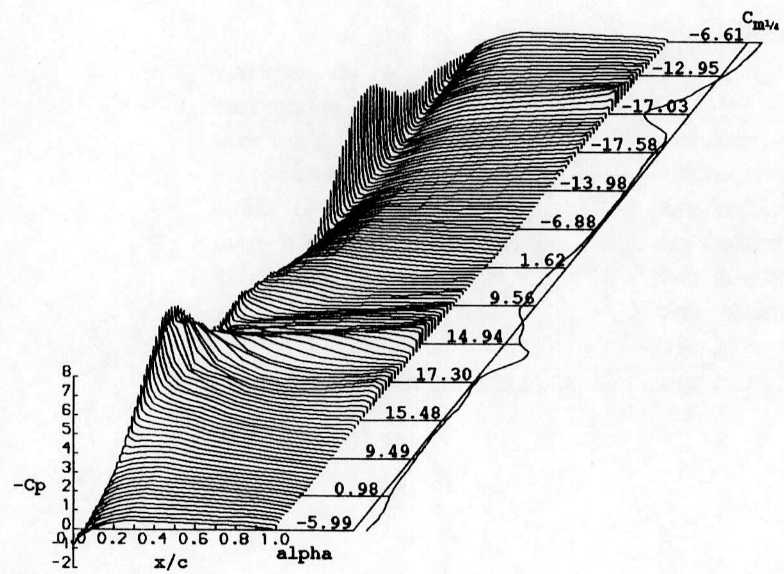
MACH NUMBER = 0.117

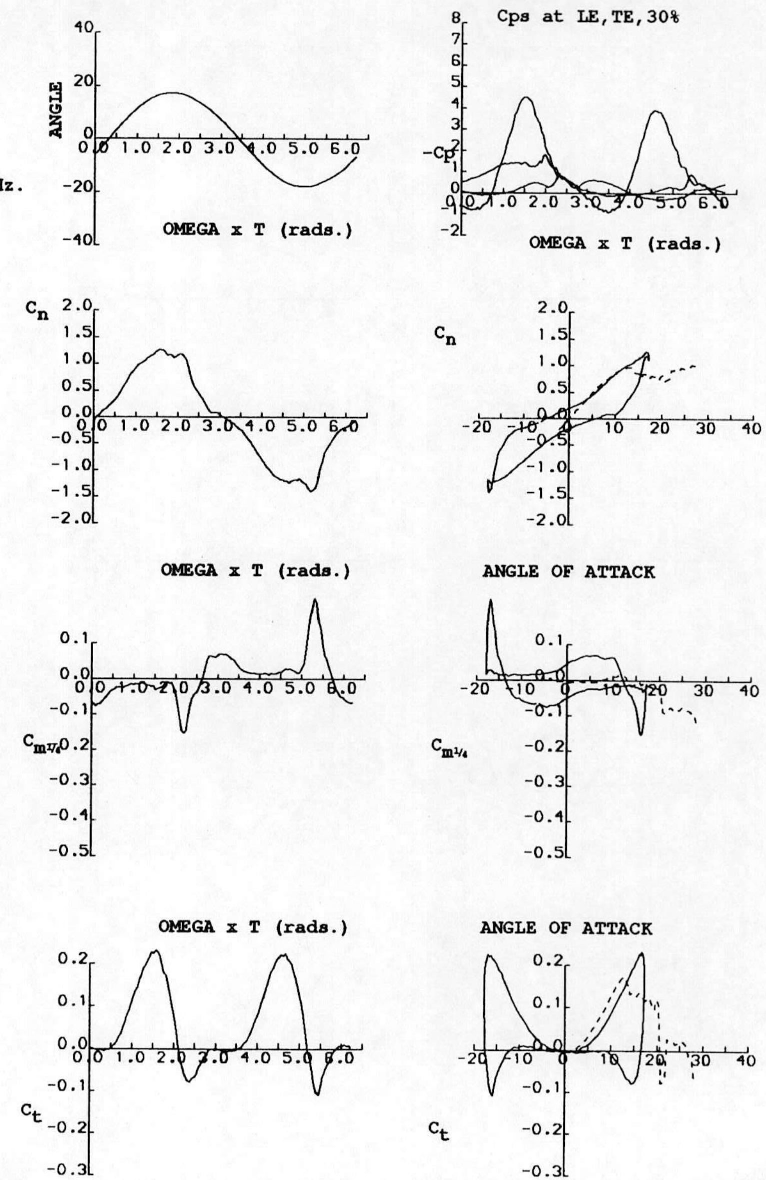
AIR TEMPERATURE = 20.0°C

SAMPLING FREQUENCY = 239.98 Hz.

REDUCED FREQUENCY = 0.081

AMPLITUDE = 17.40°

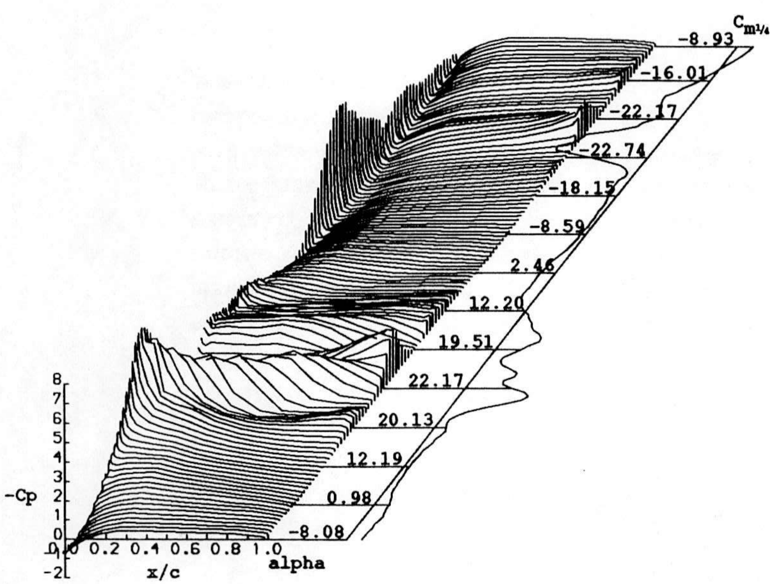


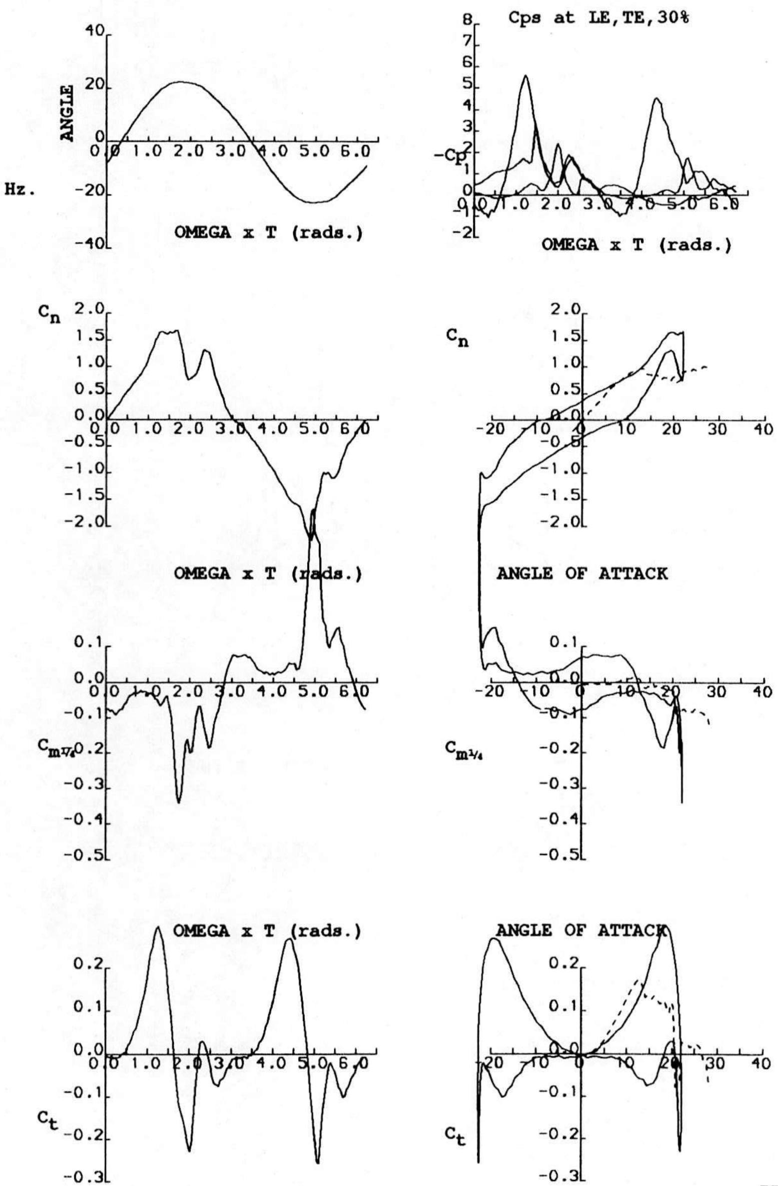


DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815551
REYNOLDS NUMBER = 1499658.
DYNAMIC PRESSURE = 977.94 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 9/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 20.2°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.081
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE GUVA10

RUN REFERENCE NUMBER: 815561
REYNOLDS NUMBER = 1498345.
DYNAMIC PRESSURE = 977.94 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.875 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 9/3/92
MACH NUMBER = 0.117
AIR TEMPERATURE = 20.4°C
SAMPLING FREQUENCY = 239.98 Hz.
REDUCED FREQUENCY = 0.080
AMPLITUDE = 30.00°