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**Thin-Walled Structures**  
**Professor Frederic Ward Williams 1940-2019**  
--Manuscript Draft--

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<b>Response to Reviewers:</b>	Please see our response to reviewers.

## Professor Frederic Ward Williams 1940-2019



This Virtual Special Issue is dedicated to the memory of the late Professor Fred Williams.

Fred Williams was the son of Sir Frederic Calland Williams, creator of the world's first electronic stored-program digital computer at Manchester. After obtaining a First Class degree in civil engineering at Cambridge he studied for a PhD at Bristol supervised by Sir Alfred Pugsley, whose old school, hands-off approach aided Fred's development as an independent researcher.

Fred spent 3 years teaching at a university in Nigeria, then joined the late Professor Bill Wittrick at Birmingham, applying his civil engineering expertise to the buckling and vibration of aircraft structures. In Fred's words, he "quickly experienced a sense of privilege, respect and even awe... Bill's courtesy and consideration were unfailing. An abiding memory is the way he would identify and remove one's areas of ignorance ... in a way which was direct but never crushing... Bill, like the best of master craftsmen, passed on by example and training the very highest standards of scholarly integrity, enthusiasm and thoroughness." These are words that perfectly describe Fred himself.

Fred recalls an occasion when "Wittrick and I worked intensively together all day, including lunch, to meet the need of one of his research students. An algorithm grew out of the discussion, to the surprise of both of us, as the result of numerous thoughts (some of which were helpful and some of which proved to be misleading). A key thought occurred over lunch but almost faded before it could be fully developed in the afternoon. Without doubt, this algorithm was the most comprehensive joint discovery of which I have first hand experience and memories of that day are still clear about twenty years later."

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In 1975 Fred became the youngest professor in Cardiff, where he remained for the rest of his career. But not before he had written a computer program VIPASA with the Wittrick-Williams algorithm at its heart.

At a conference he met Dr Melvin Anderson from NASA Langley Research Center, who went on to incorporate VIPASA into a design program which became widely used in the US aerospace industry. Melvin came to the UK for a year to work with Fred on a new analysis code VICON. With funding from British Aerospace and NASA, Fred's team at Cardiff further consolidated the software into a design code VICONOPT which is still used in the aerospace industry. Fred's collaboration with NASA also produced the 3D frame software BUNVIS-RG which was used in the design of the space shuttle.

In 1988 Fred met Professor Zhong Wanxie from Dalian University of Technology. So began a passion that continued throughout his career. He visited China every year, sometimes for several months, and also established the Cardiff Advanced Chinese Engineering Centre, hosting scores of visitors and establishing long-term collaborations with senior professors at Dalian, Tsinghua and other leading Chinese universities. The Wittrick-Williams algorithm featured in a textbook by Tsinghua's Professor Yuan Si and has become widely known in China.

As head of Cardiff's Division of Structural Engineering, Fred led by example, publishing over 400 papers and carrying his research into his teaching, particularly his final year module on plate theory. He is remembered with respect and affection by generations of research students, many of whom have advanced to successful careers in academia or industry.

To colleagues and their families he became a close friend, generous in his hospitality, keen to share his love of travelling and the great outdoors. He contributed enthusiastically to the success of the biennial International Symposium on Vibrations of Continuous Systems and organised the 2003 event at his beloved Keswick.

In 2000 Fred took up a prestigious 3 year appointment at City University of Hong Kong, returning to Cardiff to work part-time until his retirement and appointment as Emeritus Professor.

Fred's academic and research achievements were rewarded by the award of a DSc degree from Cambridge in 1985 and election to a Fellowship of the Royal Academy of Engineering in 1999.

He leaves a legacy of expertise in structural mechanics, particularly in buckling, vibration and optimisation. Most of the papers in this special issue have been contributed by researchers who were his closest colleagues, collaborators and students. In them you will find echoes of his own work, noting in particular the many references to the Wittrick-Williams algorithm. But you will also discover new areas that have been explored by these researchers, sometimes as a natural progression from their work with Fred, and sometimes branching out in completely new directions. A common feature is the academic rigour, attention to detail and precision in academic writing which Fred demonstrated consistently and instilled in his co-authors.

Fred was comforted by his lifelong Christian faith, particularly following the sad loss of his first wife Anne in 2007. He leaves a widow Ann Bull and two sons. After his death in April 2019 condolences were received from over 70 of his co-workers and students in some 20 different countries.

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## **Professor Frederic Ward Williams 1940-2019**

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