



## **Professor David Kennedy**

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Institute of Mechanics and Advanced Materials  
Cardiff University  
Cardiff School of Engineering

### **Qualifications**

Ph.D., University of Wales, Structural Engineering, 1994.

B.A., Cambridge University, Mathematics / Engineering, 1978.

### **Expertise and Research Interests**

My current research centres on the solution of nonlinear structural eigenvalue problems by exact (as opposed to finite element (FE)) methods. The characteristic approach is to assemble the static or dynamic stiffness matrix of the structure using exact member equations (eg for plane frames, space frames and plate assemblies) and to guarantee convergence on all required eigenvalues by using the Wittrick-Williams algorithm. Collaborative work with the National Aeronautics and Space Administration (NASA) and British Aerospace has led to the release of buckling and vibration programs for 3-dimensional lattice structures (BUNVIS-RG) and for prismatic plate assemblies (VICONOPT). VICONOPT includes a design capability, and is used in the aerospace industry in the UK, Europe and the USA. Particular emphasis has been placed on the efficient implementation of the

numerical algorithms used to converge on the eigenvalues, including parallel processing techniques and optimisation strategies. Current research areas include postbuckling analysis, accurate mode-finding methods, discrete optimisation and delamination of carbon-fibre composites.

In 2007 I undertook an industrial secondment at Airbus UK, funded by The Royal Society, developing software tools for the postbuckling analysis of composite aerospace structures.

### **Other Expertise**

In my previous employment at Scicon Ltd, I was engaged in the development and support of the mathematical programming system SCICONIC/ VM. With support from the BP Venture Research Unit, I spent 2 years carrying out research into methods for nonlinear optimisation. Some of the resulting special problem structures and techniques to improve the branch and board search were incorporated in SCICONIC/VM.

### **Future Research**

Accurate mode-finding techniques using the Wittrick-Williams Algorithm.

Multi-level optimisation strategies for lightweight structural design.

Postbuckling of aerospace structures.

Delamination of carbon-fibre composites.

### **Industrial Relevance**

Aerospace industry. Automotive industry.

### **Keywords**

Aeronautical Engineering, Aerospace Engineering, Computer and Information Sciences, Structural Analysis, Structural Design.

### **Additional Terms**

Branch and Bound, Buckling, Composite Materials, Computational Technique, Eigenvalue, Mathematical Programming, Nonlinear Optimisation, Parallel Computer, Postbuckling, Structural Analysis, Structural Design, Vibration.

### **Memberships**

American Institute of Aeronautics and Astronautics (Senior Member)

British Computer Society

Chartered Engineer, Engineering Council

Chartered IT Professional

Royal Aeronautical Society

### **Previous Positions**

2005-2009, Reader, Cardiff University, Structural Engineering

2000-2005, Senior Lecturer, Cardiff University, Structural Engineering

1991-2000, Lecturer, Cardiff University, Structural Engineering

1987-1993, Senior Research Associate, Cardiff University, Structural Engineering

1983-1987, Research Associate, Cardiff University, Civil Engineering and Building Technology

1978-1983, Scicon Ltd, Analyst/Programmer

1981-1983, Scicon Ltd, BP Venture Research Fellow

## Research Publications (2001 - 2012)

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- Qi Z, Kennedy D, Williams F W, A highly stable and accurate computational method for eigensolutions in structural dynamics, *Computer Methods in Applied Mechanics and Engineering* , (33-36) (2006) 4050-4059 ISSN 0045-7825
- Yuan S, Ye K-S, Wang K, Williams F W, Kennedy D, Force method for free vibration problems of framed structures (in Chinese), *Gongcheng Lixue/Engineering Mechanics* , 23 (SUPPL.2) (2006) 1-4 ISSN 10004750
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