

Professor Rob Melchers



Contact Details:

Professor of Civil Engineering
Australian Research Council Professorial Fellow
School of Engineering
Faculty of Engineering and Built Environment
Callaghan, NSW 2308
Australia

Phone: +61 2 4921 6044

Fax: +61 2 4921 6913

Email: Rob.Melchers@newcastle.edu.au

Degrees Conferred:

- Dip.Ed, Monash University, Melbourne, 1977.
- Doctor of Philosophy in Structural Engineering, University of Cambridge, England, 1972.
- Master of Engineering Science in Civil Engineering, Monash University, Melbourne, 1969.
- Bachelor of Engineering in Civil Engineering, Monash University, Melbourne, 1968.

Awards and Prizes:

- Gordon Research Conference Lecturer 2008
- The Guy Bengough Award 2007, Institute Materials, Minerals and Mining, UK, for "a paper published by the Institute which makes an outstanding contribution to the subject of corrosion and degradation of all types of materials and their control".
- TP Hoar Prize 2004 (Inst of Corrosion, UK) for best paper published in Corrosion Science in 2003 (with Dr R Jeffrey)
- Marshall Fordham Research Paper Award, Aust. Corrosion Association, 2007, 2002, 1999.
- Safety in Construction Medal, Institution of Civil Engineers, London, 2003.

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Professional Affiliations:

- Fellow, Australian Academy of Technological Sciences and Engineering
- Fellow, Institution of Engineers, Australia
- Fellow, Institution of Civil Engineers, London
- Member, [Centre for Infrastructure Performance and Reliability](#)
- Nuclear Safety Committee, Australian Radiation Protection and Nuclear Safety Authority (Federal Government regulator) (Ministerial appointment) [2000-]

Editorships:

- Foundation Editor: Australian Journal of Structural Engineering (Inst. Engineers, Australia) [1998-]
- Section Editor: Progress in Structural Engineering and Materials (J. Wiley & Sons, UK) [1997-]
- Regional Editor, Ships and Offshore Structures (Woodhead, UK) [2005-].

Editorial Boards:

- Civil and Environmental Engineering Systems (Gordon & Breach, UK) [1987-]
- Structural and Multidisciplinary Optimization (Springer, Germany) [1988-]
- Structural Safety (Elsevier, USA) [1990-]
- Reliability Engineering and System Safety (Elsevier, USA) [1998-]
- Korean Journal of Civil Engineering (Korean Society of Civil Engineers) [2006-]
- Engineering Structures (Elsevier) [2006-]

Research Interests:

- Structural engineering;
- Risk analysis of complex systems;
- Computational Aspects;
- Corrosion and deterioration mechanics.

Structural Reliability Assessment for Ships and Off-Shore Structures

Ships and offshore structures are complex structural systems subject to stochastic time-dependent loadings such as wind and wave loads.

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Structural reliability evaluation involves the uncertainties in structural strength as well as mean values, rather than nominal design values, which provide no information about the statistical nature of the material properties. For the loadings, stochastic process theory and direct modelling of the loads as processes acting on the structure are used. This does away with simplifications in load-combination modelling at the expense of having to consider more carefully and more accurately the time dependent behaviour of the structural system. Stochastic process outcrossing rate theory is being applied in a variety of application areas.

Stochastic Material Corrosion and Deterioration Modelling

The deterioration of structural materials under adverse conditions, such as the corrosion of steel in seawater environments constitutes a major cost to industry. It is desirable to predict how much corrosion is likely to occur under given (uncertain) conditions in a period of time. New models are being developed for immersion, tidal and atmospheric corrosion of steels, considering also bacterial, environmental and man-made influences. The approach is based on the use of probabilistic models for the corrosion rate processes. This is consistent with the needs of industry and with structural reliability theory. Both general corrosion and pitting corrosion are considered. Most effort has been devoted to structural steels but this is being extended to other materials.

Efficient Computational Methods for Structural Reliability

Because of the complexity of many realistic structural (and other) systems, estimation of their reliability is seldom feasible with analytic or analogue methods. Recourse must often be had to methods of simulation. The method being developed is that of Directional Simulation in the load process space. This allows the loads to be expressed directly as stochastic processes. The structural system is considered, in the general case, to be time invariant, although this restriction can be removed under certain simplifying assumptions.

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Research Grants (Competitive Funding 2003-2007):

Years	Grantees and Project Title	Source	Amount
2004-6	Melchers and Stewart Modelling and integration of spatial time-dependent variability in structural reliability analysis	ARC-DP	\$217,000
2004-6	Melchers and Stewart A study of the correlation between pre- and post demolition performance assessment for prestressed concrete beams in a 45 year old major road bridge	ARC-LP	\$115,700
2005	Melchers Risk assessment for corrosion affected concrete infrastructure	ARC Int. Linkage	\$141,000
2007-10	Melchers and Stewart Modelling of damage progression and its effects on the expected safety and satisfactory performance of existing reinforced concrete infrastructure	ARC-DP	\$240,000
2008-12	Yuan, Keller, Melchers, Stuetz, Bond Valix Optimal management of corrosion and odour problems in sewer systems	ARC-Linkage	\$4.3 million
2009-13	Melchers Mathematical modelling of tidal, splash and coastal atmospheric marine corrosion for structural reliability assessment	ARCDP / APF	\$1.18 million

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Publications:

- Please email [Prof. Melchers](#) directly for further information.

Books: (selected recent)

1. Melchers, RE (1999) *Structural Reliability Analysis and Prediction (Second Edition)* John Wiley & Sons, Chichester (reprinted June 2001, July 2002, and now reprinted on demand).
2. Melchers, R.E. and Stewart, M.G. (2000), (eds), *Applications of Statistics and Probability*, Balkema, Rotterdam.
3. Stewart MG, Melchers RE (2003) *Probabilistic Risk Assessment of Engineering Systems*, Tuttle-Mori Agency Inc, Tokyo, 251 pages (Japanese translation).
4. Melchers RE and Hough, R, (2007) (eds) *Computational Analysis of Complex Structures*, ASCE Press.

Refereed Journal Papers: 189 to end 2007

Refereed Conference Papers: 203 to end 2007