

PROCEEDINGS OF THE 20TH AUSTRALASIAN CONFERENCE ON THE MECHANICS OF  
STRUCTURES AND MATERIALS, TOOWOOMBA, AUSTRALIA, 2-5 DECEMBER 2008

# Futures in Mechanics of Structures and Materials

*Edited by*

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## Preface

The 20th Australasian Conference on the Mechanics of Structures and Materials (ACMSM20) is hosted by the Faculty of Engineering and Surveying, University of Southern Queensland, Toowoomba, Queensland, Australia. The theme for the 2008 ACMSM conference is *Futures in Mechanics of Structures and Materials*. The first Australasian conference on mechanics of structures and materials began at the University of New South Wales in 1967 as an initiative of the late Prof F.S. Shaw. Subsequently, these conferences have been held biennially as a forum for exchanging the latest research in the field of mechanics of structures and materials by researchers in the Australasian region and beyond, the last one, ACMSM19 being held at the ‘Garden City’ Christchurch, New Zealand in December 2006. It is an interesting coincidence that the ACMSM20 is held in Toowoomba, which is also known as Australia’s ‘Garden City’.

During the span of over forty years with twenty conferences in the history of ACMSM, infrastructure building in the Australasian region has continued to grow at a very rapid pace, embracing new technologies, new design methods and new materials. ACMSM has become a biennial forum for academics, researchers and practicing structural and construction engineers in the region to exchange ideas to meet the challenges in the future infrastructural development in our region. Hence, we have chosen the theme for this conference as “*Futures in Mechanics of Structures and Materials*”.

The peer reviewed papers contained in these proceedings were accepted for presentation at the ACMSM20 held in Toowoomba, Queensland, Australia, from 2–5 December 2008. These 125 papers have been authored by academics, researchers and practicing engineers from 20 countries around the world and cover a broad range of structures and materials research under the following topics:

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| Composite structures and materials             | Reliability and sustainability of structures |
| Computational mechanics                        | Shock and impact loading                     |
| Earthquake and wind engineering                | Steel structures                             |
| Fire engineering                               | Structural dynamics                          |
| Geomechanics and foundation engineering        | Structural health monitoring                 |
| Mechanics of materials                         | Structural mechanics                         |
| Rehabilitation of structures                   | Timber engineering                           |
| Reinforced and prestressed concrete structures |  |

The abstracts submitted were initially reviewed by the organising committee and authors of those abstracts that fell within the scope of the conference were asked to submit full papers for peer review. All the papers included in these proceedings were subjected to rigorous review by the experts in the relevant field. This peer review process resulted in many papers being improved and some papers being rejected.

The editors would like to thank all the keynote speakers, authors, delegates and reviewers for their effort and support for this conference. The editors are grateful to Ms. Jennifer Palisoc-Manalo for her assistance with secretarial duties for the conference.

On behalf of the ACMSM20 Organising Committee, we welcome you to Toowoomba, the Garden City, and hope that you find the conference useful and enjoyable.

Thiru Aravinthan  
Warna (Karu) Karunasena  
Hao Wang  
September 2008

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## ACMSM20 Paper review panel

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| Andrew Deeks (WA)                | Vijay Rangan (WA)          |
| Rajesh Dhakal (NZ)               | Gianluca Ranzi (NSW)       |
| Manicka Dhanasekar (Qld)         | Ravi Ravindrarajah (NSW)   |
| Jay Epaarachchi (Qld)            | Stuart Reid (NSW)          |
| Richard Fenwick (NZ)             | David Rogers (Qld)         |
| SC Fok (UAE)                     | Tracy Dong Ruan (Vic)      |
| Stephen Foster (NSW)             | Mohammad Salit (Malaysia)  |
| Sam Fragomeni (Vic)              | Bijan Samali (NSW)         |
| Wei Gao (NSW)                    | Jay Sanjayan (Vic)         |
| Ian Gilbert (NSW)                | Santhi Santhikumar (Qld)   |
| John Ginger (Qld)                | Derek Scales (WA)          |
| Helen Goldsworthy (Vic)          | Rudi Seracino (USA)        |
| Rebecca Gravina (Vic)            | Sujeeva Setunge (Vic)      |
| Muhammad Hadi (NSW)              | E Siores (UK)              |
| Hong Hao (WA)                    | Scott Smith (China)        |
| Nick Haritos (Vic)               | Mark Stewart (NSW)         |
| Mainul Islam (Qld)               | Yu Tao (China)             |
| Bassam Izzuddin (UK)             | Jin-guang Teng (China)     |
| Sakdirat Kaewunruen (Qld)        | Mochamad Teguh (Indonesia) |
| Karu Karunasena (Qld)            | David Thambiratnam (Qld)   |
| Ho-Sung Kim (NSW)                | David Thorpe (Qld)         |
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| Chong K Liew (Qld)               | Brian Uy (NSW)             |
| Samanthika Liyanapathirana (NSW) | Martin Veidt (Qld)         |
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| Guoxing Lu (Vic)                 | Mike Xie (Vic)             |
| Benjamin Lumantarna (Indonesia)  | Terikiko Yoda (Japan)      |
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