5th International Congress on Industrial and Applied Mathematics

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BOOK OF ABSTRACTS

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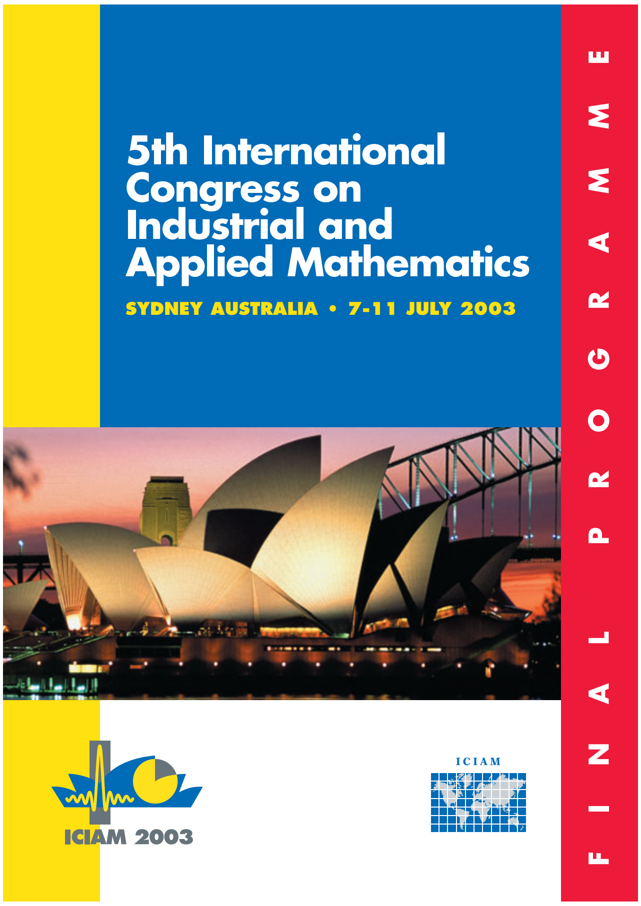

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Book of Abstracts

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Contributed presentations

ICC 11_5A–01: Bodies and Systems

ICL 11_5A–005: Mechanics in Material Space with Applications.

Reinhold Kienzler, *Professor Dr.-Ing..*

Mechanics in Material Space with Applications The notion of a force on a defect in a stressed solid is radically different from the Newtonian or physical force. The Eshelby-type force or material force is always to be understood as a relative change of the total energy of a given system with respect to some quantity which alters the configuration of that system. It becomes possible to construct the edifice of Mechanics in Material Space in parallel with the well-established classical mechanics, which now shall be referred to as Mechanics in Physical Space. To emphasize the parallelism between physical and material space, the notions like force, traction, trajectories, stability of equilibrium are juxtaposed in both spaces during the lecture. The theory is applied to problems in defect and fracture mechanics. As an example, the interaction problem between a circular hole and one or two dislocations is considered. Some elements of fracture mechanics, such as stress-intensity factors, might be developed on the basis of theories of strength-of-materials. Bars with cracks in tension and other structural members are treated. The comparison of the results with the much more evolved linear theory of elasticity reveals a rather unexpected good agreement.

ICL 11_5A–006: Global Structural Stability in Dynamics of a Rigid Body Interacting with a Medium.

Maxim V. Shamolin, *Lomonosov Moscow State University*.

In this activity the 3D motion of the body in a resisting medium is considered. It is famous that if it is interesting to investigate the motion of some rigid body in a medium it is necessary to consider both problem of the motion of a rigid body and the motion of a medium. It is suggested some method of the description of the motion of the rigid body in terms of not partial differential equations and ordinary ones. The dynamic system arising is depending of the whole class of differentiable functions. Therefore it is actual both the problem of (absolute) structural stability and relative structural stability too. As an example the interesting family of phase portraits is shown. Such family obsesses of some non-trivial non-linear properties.

ICL 11_6A–008: The Adjoint Modal Method for Non-Classical Second-Order Problems.

• Rosemaira D. Copetti, *Federal University of Santa Maria*

Julio R. Claeyssen,

We develope a direct approach of the adjoint method for non-classical systems with gyroscopic effects and internal damping in terms of a fundamental solution. This is done without using the first-order state space formulation. The bi-orthogonality relationships of the modes of partial and ordinary second-order differential systems are employed for computing a spectral expansion of the fundamental solution. The vibration mode shapes of beams, belts and rotors are determined with a dynamical basis generated by the fundamental solution and its derivatives. The computing of free and forced responses, shapes of vibration modes and eigenvalues of non-classical systems is done through numerical and symbolic simulations. These later included perturbations effects and coupling conditions through the boundary. The dynamical basis allows to simplify the computations. A polynomial approximation of the dynamical response can be introduced for the computing of the eigenvalues of systems with viscous and material damping. The polynomial coefficients are obtained by a recursion associated to the characteristic equation of the spectral problem. The use of the adjoint modal method turns out an efficient technique for obtaining responses of non-classical second-order systems in a direct manner.

ICC 11_3A–02: Granular Systems

ICL 11_3A–010: Granular Disorder and Localisation.

• Bruce Gardiner, *University of Melbourne*
• Antoinette Tordesillas, *University of Melbourne*

Particle-particle interactions have recently been incorporated into continuum models for dry granular media in an attempt to introduce a length scale. The need for a length scale becomes apparent when modelling many important phenomena, such as shear bands. Using a micromechanically-based, Cosserat-type constitutive model the shear banding problem in a biaxial test is investigated. The subsequent discussion concentrates on the effects of anisotropies in the granular fabric, and their evolutions, on predicted shear band characteristics such as width, expected inclination and rotation gradients. Perhaps counter-intuitively, the persistence of shear bands is seen to be greatest for disordered granular systems.

ICL 11_2A–012: A Thermomechanical Approach to the Modelling of Micropolar Media.

• Stuart D. Walsh, *University of Melbourne*
• Antoinette Tordesillas, *University of Melbourne*