

SEMINARIOS INTERUNIVERSITARIOS MECÁNICA Y MATERIALES

Speaker: Professor Ekkehard Ramm

Department of Civil Engineering, *University of Stuttgart, Germany*
Gauss-Newton Medal of the International Assoc. on Computational Mechanics (2008).

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Lugar: Sala Verde, 1ª Planta, E.T.S.I. Caminos, Canales y Puertos,
C/Profesor Aranguren, Univ. Politécnica Madrid, Ciudad Universitaria.

The Shell – Primadonna of Structures – Modeling, Efficiency and Sensitivity

Shell Structures are the most often used structural elements in nature and technology. The outstanding success is due to the curvature allowing a thin shell to carry transversal loading primarily by in-plane action. As a consequence shell structures can be designed with an extreme slenderness leading to a high efficiency. This is independent of the specific scale; they might be small like cell membranes and thin films for MEMS or very large like fuselages and cooling towers. Typical for optimized systems shells might be extremely parameter sensitive. As an example the well-known imperfection sensitivity sometimes leading to a sudden buckling failure is mentioned. This seminar starts with an overview on modeling coming along with the notion of dimensional reduction. Here the direct, derived and hybrid approaches are distinguished. In the last years a distinct tendency towards so-called solid-shell models can be recognized where the entire three-dimensional set of strains and stresses is maintained still keeping the idea of dimensional reduction. A so-called 7-parameter formulation for arbitrarily large deformations is introduced. It is the lowest possible solid-shell model being asymptotically correct. We will also discuss the problem of conditioning in the context of iterative solvers. Shell structures in the computational environment underlined by several numerical examples will also be addressed. Since the initial geometry for the “prima donna of all structures” is a key parameter structural optimization and form finding principles for shells and membranes are discussed. Next we will mention typical buckling problems and the interaction between fluids and thin-walled structures.

Brief CV of Ekkehard Ramm

Ekkehard Ramm is internationally recognized for his contributions in the broad area of structural mechanics, such as non-linear analyses of thin-walled structures, finite element technology, structural optimisation, material modelling, multi-scale problems, contact mechanics and fluid-structure interaction. He has been awarded honorary doctorates from several universities and is elected member of different Academies of Sciences, among them the German Academy of Technical Sciences (acatech), the Academia Europaea, the Austrian Academy of Sciences and the US National Academy of Engineering.

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