# Computational modeling of shells - Classical strategies and recent developments

Manfred Bischoff[1] Ralph Echter Bastian Oesterle Johannes Irslinger

The first generally accepted theory for analysis of shells has been presented by August E.H. Love 124 years ago. Its theoretical structure and principal ideas are still utilized today. Nevertheless, research on shell theories and solution methods has been an extraordinarily active field ever since and still today significant progress seems to be possible. Particularly the advent of computational methods, like the finite element method, in the second half of the past century has triggered an enormous variety of shell models and formulations.

The concept of degeneration and, more recently, formulation of three-dimensional shell models have received a great deal of attention. So-called 'continuum-shell' elements are available in commercial codes since a couple of years. In this context, shell theory may as well be regarded as a semi-discretization of the spatial domain in thickness direction.

One of the prominent issues of finite element technology for shells is the problem of 'locking' arising from the bad conditioning of the equations governing mechanical behavior of thin-walled structures. Here, recent developments in the field of spline-based finite element formulations along with the so-called isogeometric concept offer both new challenges and possibilities. An intrinsically locking-free isogeometric shell formulation, developed at the Institute of Structural Mechanics in Stuttgart is presented and some numerical experiments demonstrate its features.

[1] Institut für Baustatik und Baudynamik (Institute of Structural Mechanics) , Universität Stuttgart, bischoff@ibb.uni-stuttgart.de