

ADVANCED BEAM MODELS - DEVELOPMENT AND APPLICATION

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ABSTRACT

Structural analysis of beam models is frequently encountered in practice including a wide range of civil, architectural, mechanical, naval or aeronautical engineering applications. Comparing to more elaborate models of shell or solid elements, simulations with beams remain practical due to reduced modelling effort and easier model handling, permit isolation of structural phenomena offering a better insight on the structural performance and improve the computational efficiency. Additionally, due to the aforementioned advantages, beam models facilitate parametric studies (shell or solid modelling often requires construction of multiple models). Thus, extensive work has been done over the last decades to develop advanced straight or curved beam elements based on higher-order or generalized beam theories for static and dynamic as well as linear and nonlinear analyses of beam-like structures. These formulations have incorporated the axial-flexure-shear interaction, shear deformation effects, torsional and shear warping, in-plane deformation of the cross section (Poisson effects and distortion), Wagner effects and the transmission of forces at joints into the analysis. Furthermore, significant advances in simulation methods and computational tools have enabled the development of more complex three-dimensional shapes of beam models that carry external loads or pre-stress with optimal use of material. These models can be treated computationally by structural optimization or form-finding analysis. Structural optimization led to the use of beam-like models for the optimal design of structures varying in scale from lightweight cellular materials to framed towers with straight or curved chords and, thus, expanded the application field of beam models. Form-finding procedure has allowed the emergence of new structural types as bending- and/or torsion-active elements expanding the application field further.

The main scope of this mini-symposium is to host a forum where researchers involved in the development and application of advanced beam models will be able to present and discuss their work as well as exchange their ideas. Participants will contribute to the communication

of cutting-edge achievements in this continuously growing scientific domain and will gain a clear picture of its current state-of-the-art.