

Keynote Lecture

Advancing finite element technology: Developments in shell and beam elements

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ABSTRACT

Shell and beam finite elements are among the most widely used elements in finite element analysis. This keynote lecture presents an overview of the major developments in shell and beam finite element technology over the past decade. The evolution of shell elements has been closely tied to efforts to mitigate locking phenomena. In this context, special attention is given to the MITC4+ four-node shell element and the MITC3+ three-node shell element, both of which demonstrate significant improvements in accuracy and robustness. The development of beam finite elements is vast and diverse. This lecture highlights the progression from continuum mechanics-based beam formulations to their applications in the analysis of composite beams and cable strands. These developments reflect the theoretical and practical advances that have shaped modern beam modeling. Both shell and beam elements exhibit consistent performance not only in linear analysis but also under nonlinear conditions. The lecture concludes with a discussion on the future directions for enhancing the usability and reliability of shell and beam finite elements in advanced simulation environments.

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