



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title: **Mixed Formulations to Alleviate Locking in Finite Element Analysis and Isogeometric Analysis**

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SHORT ABSTRACT

The present work addresses locking in conventional finite element analysis (FEA) and isogeometric analysis (IGA) by proposing novel strategies to mitigate the issue. It begins with a comparative evaluation of various locking alleviation techniques, focusing on parameters such as accuracy, robustness, and efficiency. The work provides an elaborate understanding of the relative accuracies of individual methods, the shortcomings of the available strategies, and the key parameters influencing the selection of a particular method. The study then proposes several novel enhanced assumed strain (EAS) elements, effectively alleviating locking in FEA and thereby significantly improving the applicability of EAS elements in the FEA community. The work further explores the issue of locking in IGA, proposing effective alleviation strategies that demonstrate superior accuracy on coarse meshes, eliminate stress oscillations, and ensure overall stability throughout the analysis. Notably, the work proposes a family of stress-based solid hybrid elements to alleviate locking in non-uniform rational B-spline (NURBS)-based IGA marking a progressive development in enhancing the utility of IGA. Lastly, the present work develops strain-based solid EAS elements tailored for NURBS-based IGA, expanding their potential within the computational mechanics community.