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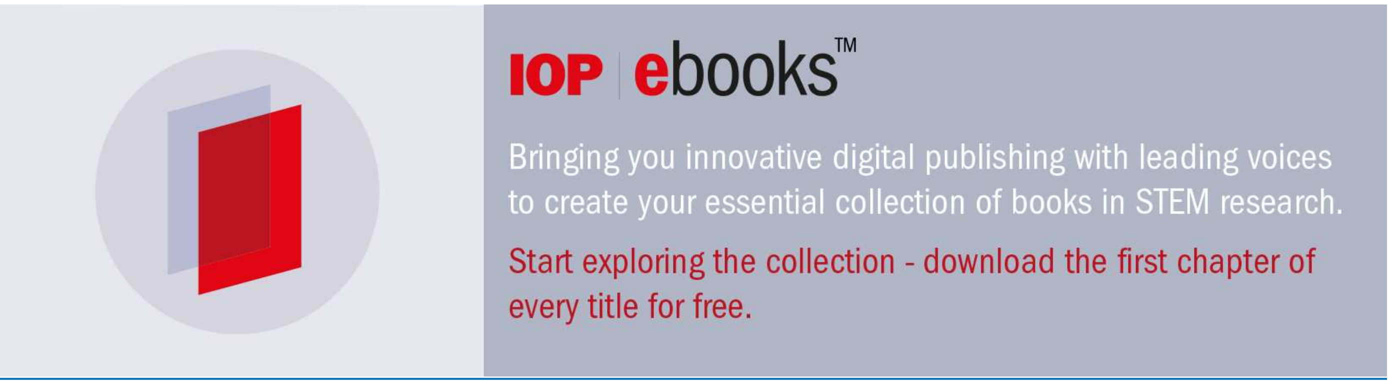

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Isogeometric Analysis of Deformation, Inelasticity and Fracture In Thin-Walled Structures

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The basic idea of isogeometric analysis (IGA) is to use splines, which are the functions commonly used in computer-aided design (CAD) to describe the geometry, as the basis function for the analysis as well. A main advantage is that a sometimes elaborate meshing process is by-passed. Another benefit is that spline basis-functions possess a higher-order degree of continuity, which enables a more accurate representation of the stress. Further, the order of continuity of the basis-functions can be reduced locally by knot insertion. This feature can be used to model interfaces and cracks as discontinuities in the displacement field.

In order to study failure-mechanisms in thin-walled composite materials, an accurate representation of the full three-dimensional stress field is mandatory. A continuum shell formulation is an obvious choice. Continuum shell elements can be developed based on the isogeometric concept. They exploit NURBS basis functions to construct the mid-surface of the shell. In combination with a higher-order B-spline basis function in the thickness direction a complete three-dimensional representation of the shell is obtained. This isogeometric shell formulation can be implemented in a standard finite element code using Bézier extraction.

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Weak and strong discontinuities can be introduced in the B-spline function using knot-insertion to model material interfaces and delaminations rigorously as discontinuities in the displacement field. The exact representation of material interfaces vastly improves the accuracy of the through-the-thickness stress field. The ability to provide a double knot insertion enables a straightforward analysis of delamination growth in layered composite shells. Illustrative examples will be given.

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