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Error Estimates for Advanced Galerkin Methods

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- Sheds light on various aspects of the error estimation procedures, as well as on nonlinear problems within the framework of finite hyperelasticity
- Showcases comparative numerical examples for problems in elastic fracture mechanics
- Provides a comprehensive compendium, from continuum mechanics, boundary value problems and their discretization, as well as numerical integration into error estimation procedures

This monograph provides a compendium of established and novel error estimation procedures applied in the field ofComputational Mechanics. It also includesdetailed derivations of these proceduresto offer insights into the concepts used to control the errors obtained from employing Galerkin methods in finite and linearized hyperelasticity. The Galerkin methods introduced are considered advanced methods because they remedy certain shortcomings of the well-established finite element method, which is the archetypal Galerkin (mesh-based) method. In particular,this monographfocuses onthe systematical derivation of the shape functions used to constructbothGalerkin mesh-based and meshfree methods. The mesh-based methods consideredarethe (conventional) displacement-based, (dual-)mixed, smoothed, and extended finiteelement methods. In addition, it introduces the element-free Galerkin and reproducing kernel particle methods as representatives of a class of Galerkin meshfree methods. Including illustrative numerical examples relevant to engineering with an emphasison elastic fracture mechanics problems,thismonograph is intendedfor students,researchers, and practitioners aiming toincrease the reliability of theirnumericalsimulationsand wanting to better grasp theconcepts of Galerkin methodsandassociated errorestimation procedures.

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