Postprint of Strain Energy Release Rate Analysis Based on Nonconforming Generalized Mixed Elements

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Abstract

To improve the accuracy of strain energy release rate calculations by models combining the displacement finite element method with the virtual crack closure technique, a non-conforming generalized mixed element method is proposed for computing the strain energy release rate in cracked plate structures through the integration of the non-conforming generalized mixed method with the virtual crack closure technique. The coupling between the non-conforming generalized mixed element method and the virtual crack closure technique is straightforward and intuitive. The method simultaneously incorporates both displacement and stress boundary conditions into the finite element model, providing a theoretically rigorous formulation while avoiding the drawback of traditional mixed methods where zero diagonal elements cause solution instability. On the other hand, the linear equation system of this method can share the same solver with that of the displacement finite element method, resulting in stable numerical solutions. Theoretically, enhanced accuracy is achieved for the numerical results of displacement, stress, and nodal forces obtained through this method. Numerical studies demonstrate that the strain energy release rate results obtained from the proposed method converge stably and reliably, and under identical mesh densities, the numerical accuracy is superior to that of the non-conforming displacement finite element method.

Full Text

Preamble

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