6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

Solid-shells based on reduced integration - geometrically non-linear analysis of layered structures

O. Barfusz[1,*] and S. Reese[1]

[1] Institute of Applied Mechanics, RWTH Aachen University, Aachen
[*] oliver.barfusz@rwth-aachen.de, www.ifam.rwth-aachen.de

Keywords: *Finite-Element Technology, Non-Linear Analysis, Composite Structures*

Some years ago, a family of solid-shell finite elements based on reduced integration [1],[2],[3] was investigated. Many engineering problems with isotropic material behaviour were considered and these elements showed accurate results while beeing more efficient than similar three-dimensional formulations based on full integration. The objective of the present contribution is to extend the analysis to layered structures with anisotropic material behaviour undergoing large deformations. Here, we follow an ansatz which is similar to so called equivalent single layer theories, i.e. we model the inhomogeneous material as a continuum using solely one solid-shell element over the thickness. Therefore, some modifications of the element formulation are needed. First, we introduce an additional mapping procedure which enables both, the usage of a certain quadrature rule within each layer of the composite and the consideration of layers with different thicknesses. Second, we investigate an appropriate hourglass-stabilization which is needed to recover so-called zero energy modes which might arise from the reduced integration scheme. Considering different benchmark problems from the literature, it will be shown that the new developed ingredients within the solid-shell concept lead to accurate results in terms of the global response of anisotropic structures at large deformations.

REFERENCES

[1] S. Reese, International Journal for Numerical Methods in Engineering **69**, pp. 1671–1716, 2007.

[2] M. Schwarze, S. Reese, International Journal for Numerical Methods in Engineering **85**, pp. 289–329, 2011.

[3] J. Frischkorn, S. Reese, Computer Methods in Applied Mechanics and Engineering **265**, pp. 195–212, 2013.