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

STABILITY OF LOCAL OUT-OF-PLANE DEFORMATIONS OF ORTHOTROPIC SHEET: NUMERICAL APPROACH

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Key words: *Simulation, Finite Element Method, Structure, Heterogeneity, Stability, Out-of-plane Deformation*

Local variations in dimensional changes generate internal forces into material. These variations arise, for example, from material heterogeneity or from an uneven thermal or moisture field. Internal forces can cause different in-plane compressive forces as well as out-of-plane bending moments. This means that, in the case of a plate or sheet, both the buckling and bending type of out-of-plane deformation tendencies may occur. Buckling and nonlinear geometry may cause challenges in the reliable numerical prediction of the out-of-plane response. Finite element analysis is performed for an experimental plate structure using the orthotropic hygro-elasto-plastic model. Two aspects related to the simulated out-of-plane deformations are considered: the influence of boundary conditions and the effect of the sheet size and shape on stability. The results show the importance of the boundary conditions when cockling is compared to a production machine sample and highlight the strength of the structural variation to cause local bending, thus stabilizing the solution.