# Benchmark Finite Element Simulations of Post-buckling Composite Stiffened Panels

CRC-ACS is one of 15 international participants in the European Commission's 6th Framework Project COCOMAT, a four year project aiming to exploit strength reserves in composite post-buckling stiffened panels through the more accurate prediction of collapse. The first task in this project is a benchmarking exercise, in which all participants analyse a common set of test cases, and results compared to assess the merits of each analysis approach. This paper outlines CRC-ACS work in this exercise, involving the analysis of two benchmark cases of post-buckling stiffened panels without damage. Analysis was carried out using MSC.Nastran and MSC.Marc, and compared to experimental data generated previously at Technion, Israel and DLR, Germany. The Finite Element (FE) analysis gave very good comparison in the pre-buckling and initial post-buckling regions, with excellent predictions of stiffness, and accurate representations of the initial post-buckling mode shape, leading to fair comparison in deep post-buckling. Accurate modelling of boundary conditions and panel imperfections were crucial to achieve accurate results, with boundary conditions in particular presenting the most difficult and critical problem, both in modelling and in experimental testing. A comparison between FE codes showed that MSC.Nastran and MSC.Marc gave almost identical results, across all panel characteristics, with only slight variations in deep post-buckling stiffness and differences in some panel strains. The accuracy of the FE results was contingent on tightening the convergence tolerances from the software defaults, which significantly increased computational time. MSC.Nastran was generally the more efficient solver, principally due to differences in automatic load step incrementation between codes. The work in this paper will be compared to subsequent work in the next benchmarking task, which involves analysis of similar post-buckling stiffened panels including damage.