

Improved Material Exploitation of Composite Airframe Structures by Accurate Simulation of Postbuckling and Collapse – The Projects POSICOSS and COCOMAT

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European aircraft industry demands for reduced development and operating costs, by 20% and 50% in the short and long term, respectively. Supported by the European Commission the project POSICOSS, which lasted from January 2000 to September 2004 and the 4-year follow-up project COCOMAT, which started in January 2004, contribute to this aim. Both projects are co-ordinated by DLR, Institute of Structural Mechanics. They allow for a structural weight reduction by exploiting considerable reserves in primary fibre composite fuselage structures through an accurate and reliable simulation of postbuckling and collapse.

The POSICOSS team developed improved, fast and reliable procedures for buckling and postbuckling analysis of fibre composite stiffened panels of future fuselage structures. For the purpose of validation comprehensive experimental data bases were created. Finally, design guidelines were derived. The COCOMAT project builds up on the POSICOSS results and goes beyond by simulation of collapse. That requires knowing about degradation due to static as well as low cycle loading in the postbuckling range. COCOMAT will improve existing slow and fast simulation tools and will set up design guidelines for stiffened panels which take skin stringer separation and material degradation into account. Reliable fast tools serve to allow for an economic design process, whereas very accurate but necessarily slow tools are required for the final certification. The results will comprise a substantially extended data base on material properties and on collapse of undamaged and pre-damaged statically and low cyclically loaded structures, degradation models, improved slow and fast computation tools as well as design guidelines.

Regarding loads and characteristic dimensions the projects POSICOSS and COCOMAT are oriented towards an application in the field of fuselage structures, but the results are transferable to other airframe structures as well. With the new design guidelines the aircraft industry will have a tool at its disposal, which substantially contributes to the objectives of reducing development and operating costs, by 20% and 50% in the short and long term, respectively. That provides the chance for decisive improvements in competitiveness of future European aircraft.

This paper presents an overview of major results from the POSICOSS project as well as the objectives and planned tasks of COCOMAT. In addition, DLR's first findings of the COCOMAT project are given.