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Research Interests:

Aerospace, Laminated Composites, Aeronautical Engineering, Composites, Composite Structures, Structural Engineering

Selected Publications:

Mariano Arbelo, Saullo Castro, Annemarie Herrmann, Regina Khakimova, Richard Degenhardt, “Investigation of buckling behavior of carbon fiber-reinforced composite shell structures with openings”, 1st International Conference on Mechanics of Composites, DLR

ABSTRACT: One can find several structures prone to buckling, with openings, for space applications. The European launcher Ariane 5 is capable to put in orbit two satellites at the same time. To do that, the upper satellite is supported by a composite structure called SYLDA. Inside the SYLDA the second satellite is placed. The launcher deploys the first satellite, then release the SYLDA and finally deploys the smaller satellite. The SYLDA structure must support the entire payload from the upper satellite during launch, but also it is required to have some holes for inspection and connection of the smaller satellite inside. The influence of these cutouts should be considered for the structural analysis in order to predict the correct buckling load. Furthermore, another critical structure with openings is the Inter Stage Structure. The entire payload is supported by this structure during launching.

Regina Khakimova, Rolf Zimmermann, Saullo Castro, Mariano Arbelo, Richard Degenhardt, “An empirical formula for the design load obtained by use of Single Perturbation Load Approach”, 1st International Conference on Mechanics of Composites, DLR

ABSTRACT: The stability of shell structures has been an object of studies for more than a century. Thin walled cylindrical and conical structures are widely used in aerospace, offshore, marine, civil and other industries. The

importance of taking into account geometric imperfections for cylindrical and conical thin-walled structures in buckling had been already recognized a long time ago. In spite of a multitude of publications on buckling of imperfect shells, such structures are still today generally designed at the preliminary design phase according to the NASA SP-8007 [1] for cylinders and the NASA SP-8019 [2] for truncated cones. Both guidelines date from 1960's and they are based on a lower bound curve which does not consider important mechanical characteristics of laminated composite shells, such as the stacking sequence, thus producing configurations that are over-conservative or even non-conservative for some cases.

Koiter in 1945 [3] was the first who theoretically demonstrated the already experimentally observed imperfection sensitivity that affects the buckling behavior of thin-walled structures. Nowadays, with the everyday increasing computational power, it becomes easier to consider imperfections in numerical simulations. However, in the early design stage the real geometric imperfection pattern of a new type of structure is not available. The Single Perturbation Load Approach (SPLA), a design method developed by Hühne [4], is a deterministic approach where a lateral load is applied prior to the axial compression (Figure 1), stimulating a single dimple. At this dimple the buckling process will start and a single buckle is produced, which will then propagate until the structure collapses. This....

R. Khakimova, S. Castro, R. Degenhardt, D. Wilckens, M. Kepke, B. Hildebrandt, F. Odermann (DLR, PFH), "Buckling experiments on imperfection sensitive thin-walled structures using additional perturbation loads", Third International Conference on Buckling and Postbuckling behavior of Composite Laminated Shell Structures with DESICOS Workshop, 25-27 March, 2015

R. Khakimova, R. Degenhardt (DLR), "Assessment of the Single Perturbation Load Approach on composite conical shells", Third International Conference on Buckling and Postbuckling behavior of Composite Laminated Shell Structures with DESICOS Workshop, 25-27 March, 2015

S. Castro, R. Khakimova, G. Ziegmann, D. Degenhardt, R. Degenhardt, Mark Hilburger (PFH, DLR, TU Clausthal, Sogeti, NASA), "Simulation of geometric imperfections and uneven edges in thin-walled cylinders", Third International Conference on Buckling and Postbuckling behavior of Composite Laminated Shell Structures with DESICOS Workshop, 25-27 March, 2015

S. G. P. Castro, C. Mittelstedt, M. A. Arbelo, R. Degenhardt, R. Khakimova, M. W. Hilburger, G. Ziegmann (PFH, DLR, NASA, TU Clausthal), "Non-linear buckling response of unstiffened laminated composite cylinders using different geometric imperfections", Third International Conference on Buckling and Postbuckling behavior of Composite Laminated Shell Structures with DESICOS Workshop, 25-27 March, 2015