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Some Publications:

Arbocz, J., and Hol, J. M. A. M., “ANILISA – Computational Module for Koiter’s Imperfection Sensitivity Theory,” Report LR-82, Delft University of Technology, Faculty of Aerospace Engineering, The Netherlands, January 1989.

Árbocz, J.; and Hol, J. M. A. M.: Koiter’s Stability Theory in a Computer-Aided Engineering (CAE) Environment. Int. J. Solids & Struct., vol. 26, no. 9–10, 1990, pp. 945–973.

J. Arbocz and J.M.A.M. Hol (Delft University of Technology, The Netherlands), “Koiter's stability theory in a computeraided engineering (CAE) environment”, International Journal of Solids and Structures, Vol. 26, Nos. 9-10, 1990, pp. 945-973, doi:10.1016/0020-7683(90)90011-J
ABSTRACT: The development of “DISDECO”, the **D**elft **I**nteractive **S**hell **De**sign **Co**de is described. The purpose of this project is to make the accumulated theoretical, numerical and practical knowledge of the last 20 years readily accessible to users interested in the analysis of buckling sensitive structures. With this open ended, hierarchical, interactive computer code the user can access from his work-station successive programs of increasing complexity. Included are modules that contain Koiter's imperfection sensitivity theory extended to anisotropic shell structures under combined loading. The nonlinear Donnell-type anisotropic shell equations in terms of the radial displacement W and the Airy stress function F are used. The circumferential dependence is eliminated by Fourier decomposition. The resulting sets of ordinary differential equations are solved numerically via the “Shooting Method”. Thus the specified boundary conditions can be enforced rigorously not only in the pre-buckling but also in the buckling and post-buckling problem. Initial results indicate that in order to obtain reliable results for anisotropic shells rigorous enforcing of the edge restraint and of the boundary conditions is indeed a must.

J. Arbocz and J.M.A.M. Hol (Delft University of Technology, The Netherlands), “On the numerical simulation of the buckling of imperfect shells”, in Buckling of shell structures, on land, in the sea, and in the air, edited by J. F. Jullien, 1991, International Colloquium on Buckling of Shell Structures, Lyon, France, Spon Press, 2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN, ISBN 1-85166-716-4
ABSTRACT: The development of “DISDECO”, the Delft Interactive Shell Design Code, is described. The purpose of this project is to make the accumulated theoretical, numerical and practical knowledge of the last 20 years readily accessible to users interested in the analysis of buckling-sensitive structures. With the open ended, hierarchical, interactive computer code the user can access from his work-station successive programs of increasing complexity. Included are modules that contain Koiter’s imperfection sensitivity theory extended to anisotropic shell structures under combined loading. The nonlinear Donnell-type shell equations in terms of the radial displacement W and the Airy stress function F are used. The spatial dependence is eliminated by Fourier decomposition. The resulting sets of algebraic equations form a standard matrix eigenvalue problem. Initial results indicate that an interactive use of these simple modules can greatly facilitate the search for an optimal lay up of composite shells under combined loading.

J. Arbocz and J. M. A. M. Hol (Faculty of Aerospace Engineering, Delft University of Technology, Delft, The Netherlands), “Collapse of axially compressed cylindrical shells with random imperfections”, Thin-Walled Structures, Vol. 23, Nos. 1-4, 1995, pp. 131-158, Special Issue: Buckling Strength of Imperfection-sensitive Shells, doi:10.1016/0263-8231(95)00009-3
ABSTRACT: The establishment of an International Imperfection Data Bank is discussed. Characteristic initial imperfection distributions associated with different fabrication techniques are shown. Using a first-order, second-moment analysis, a stochastic method is presented, whereby the stability of isotropic, orthotropic and anisotropic nominally circular cylindrical shells under axial compression, external pressure and/or torsion possessing general nonsymmetric random initial imperfections can be evaluated. Results of measurements of initial imperfections are represented in Fourier series and the Fourier coefficients are used to construct the second-order statistical properties needed. The computation of the buckling loads is done with standard computer codes and includes a rigorous satisfaction of the specified boundary conditions. It is shown that the

proposed stochastic approach provides a means to combine the latest theoretical findings with the practical experiences spanning about 75 years in an optimal manner via the advanced computational facilities currently available.

J. Arbocz, J.M.A.M. Hol and J. de Vries, "Part IV. The effect of initial imperfections on shell stability", in Modern problems of structural stability, edited by Alexander P. Seyranian and Isaac Elishakoff, ISBN 3-211-83697-7, 2002, Springer-Verlag (CISM Courses and Lectures No. 436, International Centre for Mechanical Sciences)
ABSTRACT: The development of "DISDECO", the Delft Interactive Shell DEsign COde, is described. The purpose of this project is to make the accumulated theoretical, numerical and practical knowledge of the last 20 years readily accessible to users interested in the analysis of buckling of sensitive structures. With this open ended, hierarchical, interactive computer code the use can access successively from his workstation programs of increasing complexity.

Arbocz, J. and Hol, J. M. A. M., On the reliability of buckling load predictions, AIAA Paper 94-1371, Proc. 35th AIAA Structures, Structural Dynamics, and Materials Conference, Hilton Head SC, 514-527 (1993).

Arbocz, J. and Hol, Jan M.A.M., "On a Verified High-Fidelity Analysis for Axially Compressed Orthotropic Shells," 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference, 18-21 April 2005, Austin, Texas, AIAA 2005-2302, 10 p., CD-Rom.
ABSTRACT: As a step towards developing a new design philosophy, one that moves away from the traditional empirical approach used today in design towards a science-based design technology approach, a test series of 5 lightly stiffened orthotropic shells carried out by Singer, Arbocz and Babcock at Caltech is used. In earlier publications a hierarchical high-fidelity analysis procedure for predicting the critical buckling load of compression-loaded thin-walled shells is described. This hierarchical procedure includes three levels of fidelity for the analysis, Level-1 assumes that the shell buckling load can be predicted by the classical solution with simply supported boundary condition, and with a linear membrane prebuckling solution. Level-2 includes the effects of a nonlinear prebuckling solution and the effects of boundary conditions. Level-3 is a two-dimensional analysis, which includes the nonlinear interaction between nearly simultaneous buckling modes. As a final step in the hierarchical analysis approach, in the present paper the Level-3 buckling load prediction based on the experimentally measured initial imperfections are verified by the experimental buckling loads. Since the simulated buckling loads yield a lower bound to the experimental buckling loads of all five shells tested, it is believed that the proposed hierarchical analysis procedure can be used in the design process to rapidly converge to an accurate prediction of the expected buckling load of a thin-shell design problem.

Jan Hol (Aerospace Structures, Faculty of Aerospace Engineering, Delft University of Technology, P.O. Box 5058, 2600, GB Delft, The Netherlands.) "Improved accuracy of buckling load calculations using multi-level high-fidelity analysis", Proceedings of the European Conference on Spacecraft Structures, Materials and Mechanical Testing 2005 (ESA SP-581). 10-12 May 2005, Noordwijk, The Netherlands. Edited by Karen Fletcher. Published on CD-Rom, #20.1, doi: 2005ESASP.581E..20H
ABSTRACT: Multi-level high-fidelity analysis is recognized as a viable strategy for obtaining improved safe knock-down factors based on the so-called "manufacturing signature" of a fabrication process. This approach is implemented in the hierarchical interactive computer code, DISDECO, the Delft, Interactive Shell Design Code, which enables interactive investigation of the various aspects of the nonlinear response of thin-walled shells. The goal of the research reported in this paper is the development of accurate inheritance of computed results

from low-level parametric analysis modules through intermediate approximate analysis levels to high-level large general purpose computer codes. Accurate fitting, interpolation and extrapolation of computed results as well as reformulating to accommodate alternate computational methods are major requirements. The inheritance methods are demonstrated by the hierarchical analysis of the collapse behavior of a stringer stiffened cylindrical shell.