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Publications:

The hybrid-adjoint method: a semi-analytic gradient evaluation technique applied to composite cure cycle optimization, Graeme J. Kennedy, Jorn S. Hansen, Optimization and Engineering, vol. 11, no. 1, pp. 23-43, 2010

Structural topology optimization for multiple load cases using a dynamic aggregation technique. Kai James, Jorn Hansen, Joaquim Martins, Engineering Optimization, vol. 41, no. 12, pp. 1103-1118, 2009

Cost-based, integrated design optimization, Azhar Iqbal, Jorn S. Hansen, Structural and Multidisciplinary Optimization, vol. 32, no. 6, pp. 447-461, 2006

Shape optimization of stiffeners in stiffened composite plates with thermal residual stresses, X. Wang, D. C. D. Oguamanam, J. S. Hansen, Structural and Multidisciplinary Optimization, vol. 30, no. 1, pp. 38-42, 2005

Layout optimization of stiffeners in stiffened composite plates with thermal residual stresses, Xiangmin Wang, J. S. Hansen, D. C. D. Oguamanam, Finite Elements in Analysis and Design, vol. 40, no. 9, pp. 1233-1257, 2004

J.P. Foldager, J.S. Hansen and N. Olhoff, “Optimization of the buckling load for composite structures taking thermal effects into account”, Structural and Multidisciplinary Optimization, Vol. 21, No. 1, 2001, pp. 14-31, doi: 10.1007/s001580050164
ABSTRACT: This paper deals with optimization of the buckling load for laminated composite structures. A new methodology has been developed where thermal residual stresses introduced in the manufacturing process are included in the buckling analysis. The thermal effects are also included in the calculation of the buckling load sensitivities, and it is therefore possible to “tailor” the thermal residual stresses in order to increase the buckling load. Rectangular plates and circular cylindrical shells subjected to axial compression are considered. The structures are optimized twice; the first time the thermal residual stresses are ignored in the optimization, and the second time the thermal residual stresses are included in the optimization. These two sets of optimizations give two important results. Firstly, it is possible to increase the buckling load for the structures significantly when the thermal residual stresses are taken into account. Secondly, structures which have been optimized ignoring the effects of thermal residual stresses, may have a buckling load which is much less than expected when the effects of the thermal residual stresses are included.

Jorn S. Hansen (University of Toronto, Downsview, Ontario, Canada), “Buckling of composite structures”, Chapter 6 in Computer-aided design of polymer-matrix composite structures, edited by Suong Van Hoa, Marcel Dekker, 1995, ISBN 0-8247-9558-X
PARTIAL INTRODUCTION: When considering a structural system, perhaps one of the crucial problems facing the designer is the identification of those phenomena that are important. For example, there are quite

different concerns if the predominant loads are compressive rather than tensile; compressive loads may lead to crushing, whereas tensile load may lead to necking phenomena. If materials are ductile or brittle there are different concerns; questions of yielding and flow may dominate for ductile materials, whereas flaw sensitivity may dominate for brittle materials. This is the context within which buckling or stability considerations should be taken. The conditions that always give the warning when a stability analysis may be necessary can be summarized quite easily: the structure must be subjected to compressive loads, and the structrure must be thin. As contradictory as it may seem, these criteria are very precise and yet often ambiguous. Although thinness is absolutely essential for buckling, how"thin" is thin may be debatable. In a similar manner, identifying compressive loading situations may seem straightforward. However, some care must be exercised because a variety of loading situations may lead to compression. For example, shear buckling is quite common; in terms of principal stresses a pure shear results in a biaxial stress state with tensile and compressive principal normal stresses. It is the compressive component that causes buckling….

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"Optimization of nonhomogeneous facesheets in composite sandwich plates", Structural and Multidisciplinary Optimization, Vol. 17, Nos. 2-3, 1999, pp. 199-207, doi: 10.1007/BF01195944
ABSTRACT: The optimal design of composite sandwich plates in which the facesheets are composed of a carbon fiber/epoxy net is considered. The objective of the work is to obtain minimum mass designs while maintaining constraints on the first natural frequency and selected facesheet stress components. The facesheets are assumed to be composed of an orthotropic net of unidirectional composite fiber strips and the optimal design (the least mass design) is achieved by changing the strip widths and the spacings between them. It is demonstrated that varying the spatial fiber strip distribution can lead to significant structural advantages; in the example presented, a 32% facesheet mass reduction is achieved.

Danish Center for Applied Mathematics and Mechanics (DCAMM International Graduate Research School)
Seminars Given In 1994 (Solid Mechanics, MEK, DTU):
Hansen, Jorn S.: Advanced Composite Materials.
A series of four double lectures:
Introduction to Composite Materials, and Composite Plate Theory 1.
7. February 1994,
Composite Plate Theory 2, and Thermal Effects on Composite Laminates.
21. February 1994,
Composite Plate Analysis, and Stress Prediction
7. March 1994,
Buckling of Laminated Structures, and Overview of Thermoplastic Composites.
21. March 1994.
(Professor at Institute for Aerospace Studies, University of Toronto, Canada).

Hansen, Jorn S.: Optimal Buckling Loads of Laminated Composite Plates.
27. May 1994.
(Professor at Institute for Aerospace Studies, University of Toronto, Canada).

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"On a probabilistic stability theory for imperfection sensitive structures", International Journal of Solids and Structures, Vol. 10, No. 3, March 1974, pp. 341-359, doi:10.1016/0020-7683(74)90082-1
ABSTRACT: The concept of almost sure sample stability and sample stability in probability are formulated for elastic systems. Using a Koiter type approach these concepts are used in the analysis of imperfection sensitive structures. The applied load and the initial geometric imperfections are introduced into the analysis as random quantities. A compressed beam of finite length on a nonlinear elastic foundation is used in an example calculation.

Jorn S. Hansen (Department of Civil and Municipal Engineering, University College London, Gower Street, London W.C.1, England), "Influence of general imperfections in axially loaded cylindrical shells", International Journal of Solids and Structures, Vol. 11, No. 11, November 1975, pp. 1223-1233, doi:10.1016/0020-7683(75)90111-0
ABSTRACT: The buckling of an axially loaded cylindrical shell is considered when imperfection components corresponding to all of the classical buckling modes are taken into consideration. The analysis represents an extension of Koiter's axisymmetric solution and in the asymptotic sense due to Koiter the imperfections considered are as general as possible. The results obtained reveal many interesting aspects of shell buckling which arize for various imperfection forms. The buckling behaviour which results is associated with both bifurcation and limit point critical states.

R.C. Tennyson and J.S. Hansen, "Optimum design for buckling of laminated cylinders", in Collapse: The buckling of structures in theory and practice; Proceedings of the Symposium, London, England; United Kingdom; 31 Aug.-3 Sept. 1982. pp. 409-429. 1983
ABSTRACT: A recent test has provided significant results important for laminate composite shell design. The buckling load of composite shells may be increased substantially through the careful choice of laminate configurations. An increased buckling load capability may be combined without paying a severe penalty with regard to imperfection sensitivity, and the presence of imperfections can cause a change in failure mode from global to local. This characteristic has been observed experimentally and is consistent with analytical predictions.

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"The Dynamic Behaviour of Stiffened Composite Fuselage Shell Structures", December 1988
DTIC Accession Number: ADP005809
ABSTRACT: This report presents an overview of the development of a computer model for analysing the crash response of stiffened composite fuselage structures together with the experimental validation program. Using a finite element formulation based on Reissner/Mindlin plate theories, the numerical model can treat stiffened laminated shell buckling, large deflections, nonlinear material behaviour and element failure. Numerical results are presented for several 'test cases', although experimental comparisons are not yet available. Details on the design and construction of our first prototype composite fuselage model are also provided together with a description of the crash test facility.

A. R. de Faria and J. S. Hansen (Institute for Aerospace Studies, UTIAS, 4925 Dufferin Street, Toronto, Ontario M3H 5T6, Canada), "On buckling optimization under uncertain loading combinations", Structural and Multidisciplinary Optimization, Vol. 21, No. 4, 2001, pp. 272-282, doi: 10.1007/s001580100104
ABSTRACT: This paper proposes a technique to optimize structural components for buckling when the applied loads are partially unknown or unpredictable. As opposed to the traditional buckling optimization situation where the loading configuration is specified, the load ratios are assumed uncertain and are incorporated as variables in the optimization problem formulation. As a result, the optimal designs obtained are insensitive to load variations within an admissible convex set. Additionally, in order to generalize the results and therefore provide a systematic solution procedure, a theorem concerning the shape of the stability boundary of structures whose buckling loads are the solution of linear eigenproblems is stated and proven.

A. R. de Faria and J. S. Hansen (Institute for Aerospace Studies, UTIAS, 4925 Dufferin Street, Toronto, Ontario M3H 5T6, Canada), "Buckling Optimization of Composite Axisymmetric Cylindrical Shells Under Uncertain Loading Combinations", J. Appl. Mech., Vol. 68, No. 4, July 2001, 632 (8 pages), doi:10.1115/1.1311962
ABSTRACT: Optimal elastic buckling loads of composite axisymmetric circular cylinders under uncertain loading conditions are investigated. The mechanical loads applied to the cylinder are a combination of axial compression, lateral pressure, and torsion. Additionally, these loads are allowed to vary within a certain class of admissible loads during the optimization search, as opposed to the restriction of fixed loads in the traditional optimization. The consideration of a degree of uncertainty in the mechanical loads leads to optimal designs which are inherently insensitive to perturbations and/or randomness in the applied loads.

Hansen, J.S., 1977. General random imperfections in the buckling of axially loaded cylindrical shells. AIAA J., 15: 1250-1256. DOI: 10.2514/3.7413

Tennyson R. C. and Hansen J. S. (1983). Optimum design for buckling of laminated cylinders. In: Collapse: the buckling structures in theory and practice. (Ed. J. M. T. Thompson and G. W. Hunt) 409-429, Cambridge University Press, Cambridge.

Tennyson, R. C., Nanyaro, A. P., Teichman, H. C. and Hansen, J. S., "Crashworthiness of Light Aircraft Structures," Transport Canada Research and Development Centre Report TP3927, 1981.

Tennyson, R. C. and Hansen, J. S., "Study of the Crash Behaviour of Aircraft Fuselage Structures," in Structural Crashworthiness, Edited by Jones, N., and Wierzbicki, T., Butterworth and Co., London and Boston, 1983, pp. 218-258.

Hansen, J. S. and Tennyson, R. C., "The Dynamic Behaviour of Stiffened Composite Fuselage Shell Structures," Proceedings of the AGARD Conference on Energy Absorption of Aircraft Structures as an Aspect of Crashworthiness, Luxembourg, AGARD-CP-443, May 1988.

Hui, D. and J.S. Hansen (1980) The swallowtail and butterfly cuspoids and their application in the initial post buckling of single mode structural systems. Quarterly of Applied Mechanics, April, p. 17-35.

Sun G & Hansen JS. Optimal design of laminated composite circular-cylindrical shells subjected to combined loads. Journal of Applied Mechanics 1988;55: p.136-142.

De Almeida, S. F. and Hansen, J. S. (1997). Free Vibration Analysis of Composite Plates with Tailored Thermal Residual Stresses. ASME International Mechanical Engineering Congress and Exposition, AD 55 ASME:183–190.