Professor Dr.-Ing. Hans-Günther Reimerdes

Dept of lightweight structures
RWTH Aachen, Germany

Research Interests:
Light weight structures, vibrations, light weight structural mechanics, structural mechanics, design principles of space craft, production technology of non-metallic composite material elements, torsion, vibration strength, fatigue strength, finite element method in light weight construction, aero-elastics, composite materials

Adresse
Rheinisch-Westfälische Technische Hochschule Aachen Fakultät für Maschinenwesen Lehrstuhl und Institut für Leichtbau

Als Antragsteller:
Entwicklung notwendiger Grundlagen für die wirtschaftliche Fertigung von großen, komplexen, sphärisch gekrümmten Faserverbundstrukturen mit integrierten Versteifungselementen (Schwerpunktprogramm)
Entwicklung notwendiger Grundlagen für die wirtschaftliche Fertigung von großen, komplexen, sphärisch gekrümmten Faserverbundstrukturen mit integrierten Versteifungselementen (Schwerpunktprogramm)

Als Teilprojektleiter:
Aeroelastische Experimente im Windkanal und Strukturmodelle elastischer Tragflügel (Sonderforschungsbereich)
Aerostrukturdynamische Methoden für den Flugzeugentwurf (Transferprojekt)
Bauteilprüfung und Qualitätssicherung (Sonderforschungsbereich)
Berechnungsverfahren für die Aerostrukturdynamik von Tragflügeln (Sonderforschungsbereich)
Entwicklung elastischer Flügelmodelle und experimentelle Untersuchungen im Windkanal sowie Konzepte und Modellierung der Tragstruktur elastischer Flügel (Sonderforschungsbereich)
Gekoppelte Lösung von Aerothermoelastizitätsproblemen im Überschall (TRR) Konstruktion und Berechnung (Sonderforschungsbereich) Strukturgewicht (Sonderforschungsbereich)

Selected Publications:

Ren Wenmin (1), Liu Wenguo (1), Zhang Wei (1), H. G. Reimerdes (2) and H. Oery (2)
(1) Department of Engineering Mechanics, Tsinghua University, Beijing 100084, China)
(2) Institute of Lichtstructure, RWTH Aachen, D-52062, Aachen, Germany
"A survey of works on the theory of toroidal shells and curved tubes", Acta Mechanica Sinica, Vol. 15, No. 3, 1999, pp. 225-234, doi: 10.1007/BF02486150
ABSTRACT: This paper gives a survey of works on the theory of toroidal shells which were done by our two universities in recent years. (49 references)

Öry, H., Reimerdes, H.-G. and García, J. G. (Department of Aerospace Structures: Lightweight Construction, Institut für Leichtbau, RWTH Aachen, Wüllnerstraße 7, 52062 Aachen, Germany),
"The design of shells and

tanks in the aerospace industry: some practical aspects", Progress in Structural Engineering and Materials, Vol. 1, No. 4, July 1998, pp. 404–414. doi: 10.1002/pse.2260010409

Garcia, J.G., J. Marsolek, and H.G. Reimerdes, Determination of the energy absorption of cylindrical shells under axial loading by analysis of the dynamic buckling and folding process. IJCrash, (1999). 4(4): p. 351-364

S. Büsing, H. Reimerdes, T. Möcker, Simulation of Postbuckling Experiments with a Fast Design Tool, Proc. of 2nd Int. Conference on Buckling and Postbuckling Behaviour of Composite Laminated Shell Structures with COCOMAT Workshop 3-5 September 2008, Braunschweig, Germany

García, J. G., Albus, J. and Reimerdes, H.-G. (Institut für Leichtbau, RTH Aachen, Wüllnerstrasse 7, D-52062, Aachen, Germany), "Static and stability behaviour of elliptical cylindrical shells under combined mechanical and thermal loads", Spacecraft Structures, Materials and Mechanical Engineering, Proceedings of the Conference held by ESA, CNES and DARA in Noordwijk, 27-29 March 1996. Edited by W.R. Burke. ESA SP-386. Paris: European Space Agency (ESA), 1996., p.295, Bibliographic code: 1996ESASP.386..295G
ABSRACT: Elliptical shell structures will increasingly be used as construction elements in future aerospace concepts. The static and the stability behavior of such non-axisymmetric shells is analyzed in this paper. To describe the behavior of the shell structures a complete tensor formulated shell bending theory considering the Kirchoff-Love hypothesis is uses. Examples are presented showing the mechanical behavior under thermal loads, surface loads, and a combination of these loads. The achieved results demonstrate the capability of the introduced calculation method.

A. Rittweger, Th. Schermann, H. -G. Reimerdes and H. Öry (Institut für Leichtbau, Technical University Aachen, Wüllnerstr, 7, 52062, Aachen, Germany), "Influence of geometric imperfections on the load capacity of orthotropic stiffened and composite shells of revolution with arbitrary meridians and boundary conditions", Thin-Walled Structures, Vol. 23, Nos. 1-4, 1995, pp. 237-254, Special Issue: Buckling Strength of Imperfection-sensitive Shells, doi:10.1016/0263-8231(95)00014-5
ABSTRACT: A stiffness matrix for an element of a shell of revolution has been derived, considering arbitrary load distributions and initial geometric imperfections. This element-stiffness matrix is based on the transfer-matrix method and describes the whole section of a shell of revolution between two rings in modal coordinates (a so-called super-element). The modal coordinates here are circumferential Fourier members, thus reducing the partial differential equations to ordinary ones. Several stability analyses investigating the sensitivity of composite shells to different geometric imperfection shapes were carried out. The influence of the load distribution and boundary conditions in combination with geometric imperfections was analysed by different modellings of a hypothetical Jupe Avant shell of the ARIANE 5 rocket.

Öry, H., Reimerdes, H.-G. and García, J. G. (Department of Aerospace Structures: Lightweight Construction, Institut für Leichtbau, RWTH Aachen, Wüllnerstraße 7, 52062 Aachen, Germany), "The design of shells and tanks in the aerospace industry: some practical aspects", Progress in Structural Engineering and Materials, Vol. 1, No. 4, July 1998, pp. 404–414. doi: 10.1002/pse.2260010409
ABSTRACT: This review highlights some practical aspects of the design of thin-walled shells for aerospace applications. This type of shell must comply with the mission profile. It is therefore necessary to find an optimum structural concept with low weight, high strength, high buckling load and a low imperfection sensitivity. In an optimum design, structural instability occurs slightly below the material strength or yield strength. In general, and by contrast with other structural elements such as beam and plates, a thin-walled

cylindrical shell shows a high imperfection sensitivity. Hence, recommendations are given concerning the design of shells and approximate stability analyses are presented for different mechanical loading conditions.

Möcker, T. & Reimerdes, H.-G. (Department of Aerospace and Lightweight Structures, RWTH Aachen University, Wüllnerstr. 7, 52062 Aachen, Germany,), "Load carrying capability of stringer stiffened curved composite panels in the postbuckling region", 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., doi: 2005ESASP.581E.143M
ABSTRACT: (cannot cut and paste abstract)

Torsten Möcker and Hans-Günther Reimerdes (Department of Aerospace and Lightweight Structures, RWTH Aachen University, Wüllnerstr. 7, 52062 Aachen, Germany), "Postbuckling simulation of curved stiffened composite panels by the use of strip elements", Composite Structures, Vol. 73, No. 2, May 2006, pp. 237-243, Special Issure: International Conference on Buckling and Postbuckling Behavior of Composite Laminated Shell Structures, doi:10.1016/j.compstruct.2005.11.061
ABSTRACT: The buckling and postbuckling behaviour of stiffened composite panels is investigated in this paper. For the analysis a procedure is applied that is based on the discretisation of the structure by strip elements. This procedure enables the determination of element stiffness matrices representing analytical solutions of the governing differential equations. Next to the presentation of the underlying theory, numerical results are given for a curved stiffened panel configuration. In order to verify the applicability of the approach, a comparison to experimental results is included.

H. Öry (1), H.-G. Reimerdes (1), T. Schmid (1), A. Rittweger (2) and J. Gómez Garcia (2)
(1) Institut für Leichtbau, Aachen University of Technology (RWTH Aachen), Germany
(2) Astrium GmbH, Space Infrastructure, Bremen, Germany
"Imperfection sensitivity of an orthotropic spherical shell under external pressure", International Journal of Non-Linear Mechanics, Vol. 37, Nos. 4-5, June 2002, pp. 669-686, Special Issue: Stability & Vibration in Thin-Walled Structures, doi:10.1016/S0020-7462(01)00091-9
ABSTRACT: In the first part of this paper, rib-stiffened thin-walled spherical shells under external hydrostatic pressure are optimized using classical approximate methods and empirical knock-down-factors. In the second part of the paper, the influence of known imperfections is investigated. The thin-walled spherical shells under external pressure are very sensitive to geometrical imperfections. Hoff recognized that for entire isotropic spherical shells the more likely imperfection will be a local circular dent, which for such shells, can always be considered as an axisymmetric one. Hoff's idea has been further investigated by Koga–Hoff, Galletly et al. These results showed that for a given depth of an imperfection a critical size of the corresponding circular dent exists, giving the minimum for the actual load carrying capacity of the shell. This paper suggests to extend Hoff's theory to isogrid and waffle-grid stiffened spherical shells. The issue of these investigations is a set of knock-down-factors plotted versus imperfection amplitude related to the total thickness of the rib-stiffened (isogrid or waffle-grid) shell. These curves fit reasonably with those established for isotropic shells by Hoff et al. or by Koiter, and enable to estimate the jeopardy of measured actual dents.