Professor Dr.-Ing. habil. Werner Wagner

See:
http://www.ibs.kit.edu/english/287_405.php
http://www.springer.com/authors?SGWID=0-111-19-152491-0
http://www.journalogy.net/Author/12624669/werner-wagner

Head of the Institute for Structural Analysis
Karlsruhe Institute of Technology

General fields of work:
Modeling of structures
Beam and shell structures
Composite materials
Numeric of elastic plastic deformations
Finite element methods
Nonlinear continuum mechanics
Stability of structures

Teaching:
Intruduction to Modeling of Structures
Statics of Structures
Computer-assisted modeling of structures
Structural analysis with commercial software I
Seminar for structural analysis

Biography and Academic Career:

07.05.1952 Born in Kassel
1973-1979 Study of Civil Engineering at Technical University of Hanover
since 1980 Research assistant at Institute of Mechanics and Computational Mechanics (IBNM), University of Hanover
1985 PhD-thesis on geometrically nonlinear elastic shells and their numerical modeling
1985 Lecturer at the IBNM, University of Hanover
1990 Akademischer Rat at the IBNM, University of Hanover
1990 Habilitation-thesis on Elastostatic stability problems within the finite element method
since 1994 Chair of structural analysis at the Institute for Structural Analysis, University of Karlsruhe (TH)
since 1991 Member of the executive board the German Association for Computational Mechanics (GACM)
since 1995 Inspection engineer for structural Analysis

More than 170 publications in national and international journals and proceedings, for example, in:

Der Bauingenieur
Stahlbau
ZAMM
Archive of Applied Mechanics
Composite Structures
Computer Methods in Applied Mechanics and Engineering
Computational Mechanics
Engineering Computations
European Journal of Finite Elements
Finite Elements in Analysis and Design
International Journal for Numerical Methods in Engineering

Some publications relating to stability:

P. Wriggers, W. Wagner, C. Miehe. “A quadratically convergent procedure for the calculation of stability points in finite element analysis.” Comp. Meth. Appl. Mech. Eng., Vol. 70, 329–347, 1988

W. Wagner, P. Wriggers. “A simple method for the calculation of postcritical branches.” Eng. Comp., Vol. 5, 103–109, 1988

Wagner W.: Zur Formulierung eines geometrisch nichtlinearen Finite Elementes für zylindrische Faserverbundschalen, Static und Dynamik in Konstruktiven Ingenieurbau, Festschrift Wilfried B. Krätzig, SFB 151 – Berichte, 1992, Nr 23, B3–B10

Sprenger W, Gruttmann F, Wagner W. Delamination growth analysis in laminated structures with continuum-based 3D-shell elements and a viscoplastic softening model. Comput Methods Appl Mech Eng 2000;185: 123–39.

Ziegler, R., Wagner, W., and Bletzinger, K.-U. (2003). A finite element model for the analysis of wrinkled membrane structures. International Journal of Space Structures, 18(1):1–14

Degenhardt R., Wagner W., Delsemme J.-P. and David A. (2003), GARTEUR Open, SM AG25, "Postbuckling and Collapse Analysis - Benchmark 3 Evaluation Report and Collected Contributions", IB – 131-2003/29, Braunschweig, DLR, 2003

Degenhardt R., Rohwer K., Wagner W., Delsemme J-P. "Postbuckling And Collapse Analysis Of CFRP Stringer Stiffened Panels – A Garteur Activity", Fourth International Conference on Thin-Walled Structures ICTWS 2004, 22-24 June 2004

C. Balzani, W. Wagner, Numerical Treatment of Damage Propagation in Axially Compressed Composite Airframe Panels. Proc. of 2nd Int. Conference on Buckling and Postbuckling Behaviour of Composite Laminated Shell Structures with COCOMAT Workshop 3-5 September 2008, Braunschweig, Germany

A.C. Orifici, S. Lauterbach, H. Abramovich, R.S. Thomson, W. Wagner, C. Balzani, Analysis of damage sensitivity and collapse in postbuckling fibre-reinforced multi-stiffener panels, Proc. of 2nd Int. Conference on Buckling and Postbuckling Behaviour of Composite Laminated Shell Structures with COCOMAT Workshop 3-5 September 2008, Braunschweig, DE

F. Gruttmann (1), W. Wagner (1), L. Meyer (1) and P. Wriggers (2)
(1) Institut fuer Baumechanik und Numerische Mechanik, Universität Hannover, Applstr, 9A, D-30167, Hannover, Germany
(2) Institut fuer Mechanik, Technische Hochshule Darmstadt, Hochschulstr. 1, D-64289, Darmstadt, Germany
"A nonlinear composite shell element with continuous interlaminar shear stresses", Computational Mechanics, Vol. 13, No. 3, 1993, pp.175-188, doi: 10.1007/BF00370134
ABSTRACT: A numerical model for layered composite structures based on a geometrical nonlinear shell theory is presented. The kinematic is based on a multi-director theory, thus the in-plane displacements of each layer are described by independent director vectors. Using the isoparametric apporach a finite element formulation for quadrilaterals is developed. Continuity of the interlaminar shear stresses is obtained within the nonlinear solution process. Several examples are presented to illustrate the performance of the developed numerical model.

F. Gruttmann and W. Wagner (Institut für Baumechanik und Numerische Mechanik, Universität Hannover, Appelstrasse 9A, 30167 Hannover, Germany), "On the numerical analysis of local effects in composite structures", Composite Structures, Vol. 29, No. 1, 1994, pp. 1-12, doi:10.1016/0263-8223(94)90032-9
ABSTRACT: A numerical model for the nonlinear analysis of thick laminates is presented. Using a multiplicative decomposition of the displacement vector in shell space, the 3D problem is reduced to a 2D problem. Although the total number of degrees of freedom is comparable to 3D brick elements this approach provides several advantages, e.g. a simplified mesh generation due to a 2D-type data structure and a better bending behavior. The developed isoparametric quadrilateral finite element is capable of predicting interlaminar stresses and local effects. Several linear and nonlinear examples are presented to illustrate the performance of the developed numerical model.

F. Gruttmann and W. Wagner (Institut für Baustatik, Universität Karlsruhe, Kaiserstraße, 76131, Karlsruhe, Germany), "Coupling of two- and three-dimensional composite shell elements in linear and non-linear applications", Computer Methods in Applied Mechanics and Engineering, Vol. 129, No. 3, 15 January 1996, pp. 271-287, doi:10.1016/0045-7825(95)00897-7
ABSTRACT: A numerical model for the non-linear analysis of laminates is presented. The developed element

is based on piecewise polynomial interpolation in thickness direction. Although the total number of degrees of freedom is comparable to a discretization with 3D brick elements this approach provides several advantages, e.g. a simple mesh generation due to a 2D-type data structure and a better bending behavior. The developed isoparametric quadrilateral finite element allows prediction of the complete stress state. Furthermore, a transition element is presented which is used to couple the developed element with 5-parameter shell elements. Several linear and non-linear examples are presented to illustrate the performance of the developed numerical model.

P. Wriggers, W. Wagner and E. Stein (Institut für Baummechanik und Numerische Mechank, Universität Hannover, FRG), "Algorithms for non-linear contact constraints with application to stability problems of rods and shells", Computational Mechanics, Vol. 2, No. 3, 1987, pp. 215-230, doi: 10.1007/BF00571026
ABSTRACT: In this paper a class of non-linear problems is discussed where stability as well as post-buckling behaviour is coupled with contact constraints. The contact conditions are introduced via a perturbed Lagrangian formulation. From this formulation the penalty and Lagrangian multiplier method are derived. Both algorithms are investigated together with an algorithm based on an augmented Lagrangian method. The resulting finite element formulation is applied to structural problems of beams and shells undergoing finite elastic deflections and rotations. For the examination of the post-buckling behaviour the arc-length method is used. The performance of the element formulation and a comparison of the different contact algorithms are demonstrated by numerical examples.

W.Wagner and P. Wriggers (Institut für Baummechanik und Numerische Mechank, Universität Hannover, FRG), "A simple method for the calculation of postcritical branches", Engineering Computations, Vol. 5 No. 2, 1988, pp.103 – 109, doi: 10.1108/eb023727
ABSTRACT: The practical behaviour of problems exhibiting bifurcation with secondary branches cannot be studied in general by using standard path-following methods such as arc-length schemes. Special algorithms have to be employed for the detection of bifurcation and limit points and furthermore for branch-switching. Simple methods for this purpose are given by inspection of the determinant of the tangent stiffness matrix or the calculation of the current stiffness parameter. Near stability points, the associated eigenvalue problem has to be solved in order to calculate the number of existing branches. The associated eigenvectors are used for a perturbation of the solution at bifurcation points. This perturbation is performed by adding the scaled eigenvector to the deformed configuration in an appropriate way. Several examples of beam and shell problems show the performance of the method.

E. Stein, W. Wagner and P. Wriggers (Institut für Baummechanik und Numerische Mechank, Universität Hannover, FRG), "Nonlinear stability-analysis of shell and contact-problems including branch-switching", Computational Mechanics, Vol. 5, No. 6, 1990, pp. 428-446, doi: 10.1007/BF01113447
ABSTRACT: In the analysis of nonlinear elastic shells often the stability and postbuckling behaviour governs the response. Here we discuss problems which also include contact constraints. A nonlinear cylindrical shell element is derived directly from the associated shell theory using one point integration and a stabilization technique. Within a general solution algorithm a simple but effective branch-switching procedure is presented. Additional considerations allow the treatment of bifurcation problems with contact constraints. Several examples of beam and shell problems show the performance of the developed algorithms and elements.

W. Wagner and E. Stein (Institut für Baumechanik und Numerische Mechanik, Universität Hannover, Appelstr. 9A, D-3000 Hannover 1, Germany), "A new finite element formulation for cylindrical shells of composite

material", Composites Engineering, Vol. 3, No. 9, 1993, pp. 899-910, doi:10.1016/0961-9526(93)90047-N
ABSTRACT: In this paper we discuss theoretical and numerical aspects of the formulation of a cylindrical shell element for composite materials. The element is based on a direct introduction of the finite element approach into the shell equations, especially for the base vectors, see Simo, J. C. et al. (1989–1992) [Comp. Meth. Appl. Mech. Engng (Part I) 72, 267–304, (Part II) 73, 53–92, (Part III) 79, 21–70, (Part IV) 81, 91–126, (Part V) 96, 133–171] and Gruttmann et al. (1989) [Ing. Arch. 59, 54–67]. Introducing the special geometry of cylinders we end up with a simple but highly accurate element which can be formulated in an easy way and which shows excellent convergence behavior in linear and nonlinear problems.

Wagner, W. (Institut für Baustatik, Universität Karlsruhe (TH), D76128 Karlsruhe, Germany), "A note on FEM buckling analysis", Communications in Numerical Methods in Engineering, Vol. 11, No. 2, February 1995, pp.149–158. doi: 10.1002/cnm.1640110208
ABSTRACT: The investigation of the non-linear response of shell-like structures requires insight into stability behaviour. In the paper we compare two strategies to compute singular points based on different eigenvalue problems. We show a simple algorithm to calculate critical load factors A used in engineering buckling analysis from the eigenvalues of the standard eigenvalue problem…Some numerical examples illustrate the derived results and algorithms.

W. Wagner, S. Klinkel, and F. Gruttmann. Elastic and plastic analysis of thin-walled structures using improved hexahedral elements. Computers and Structures, 80:857–869, 2002.

Klinkel, S. and Wagner, W. (Institut f. Baustatik, Universität Karlsruhe (TH), Kaiserstr. 12, Karlsruhe, 76131, Germany), "A geometrically non-linear piezoelectric solid shell element based on a mixed multi-field variational formulation", International Journal for Numerical Methods in Engineering, Vol. 65, No. 3, January 2006, pp. 349–382. doi: 10.1002/nme.1447
ABSTRACT: This paper is concerned with a geometrically non-linear solid shell element to analyse piezoelectric structures. The finite element formulation is based on a variational principle of the Hu–Washizu type and includes six independent fields: displacements, electric potential, strains, electric field, mechanical stresses and dielectric displacements. The element has eight nodes with four nodal degrees of freedoms, three displacements and the electric potential. A bilinear distribution through the thickness of the independent electric field is assumed to fulfill the electric charge conservation law in bending dominated situations exactly. The presented finite shell element is able to model arbitrary curved shell structures and incorporates a 3D-material law. A geometrically non-linear theory allows large deformations and includes stability problems. Linear and non-linear numerical examples demonstrate the ability of the proposed model to analyse piezoelectric devices.