Professor Robert Levy

Robert Levy (1) and William R. Spillers (2),
(1) Sr. Lect., Fac. of Civ. Engrg., Technion - Israel Inst. of Tech., Technion City, Haifa 32000 Israel
(2) Prof., Dept. of Civ. Engrg., Rensselaer Polytechnic Inst., Troy, NY 12181
"Optimal Design for Axisymmetric Cylindrical Shell Buckling", ASCE J. Engrg. Mech. 115, 1683 (1989); doi:10.1061/(ASCE)0733-9399(1989)115:8(1683)
ABSTRACT: This paper discusses the structural optimization problem of finding the optimal wall fhickness of an axisymmetric cylindrical shell so as to maximize the buckling load when the volume of material is fixed. An optimality condition is derived and then the method of truncated Fourier series is used to find an optimal design which indicates an 83% increase in buckling load over the classical critical buckling load for the case of uniform thickness.

Levy, R. and Spillers, W. (1995). Analysis of Geometrically Nonlinear Structures. Chapman and Hall.

R. Levy and E. Gal (Faculty of Civil Engineering, Technion – Israel Institute of Technology, Technion City, Haifa 32000, Israel), "Geometrically nonlinear three-noded flat triangular shell elements", Computers & Structures, Vol. 79, Nos. 26-28, November 2001, pp. 2349-2355, doi:10.1016/S0045-7949(01)00066-9
ABSTRACT: This paper provides a novel approach to the geometrically nonlinear analysis of shells by deriving the geometric stiffness matrix by load perturbing the linear equilibrium equations in their finite element formulation. Rotations are considered as finite, and rigid body motion is elegantly removed to result in pure elastic deformations that enable stress retrieval via linear constitutive relations. Simple three-noded triangular elements that have proven successful in linear analysis will thus transform to powerful nonlinear elements.

E. Gal (1), R. Levy (2), H. Abramovich (3) and P. Pavsner (3)
(1) Department of Structural Engineering, Faculty of Engineering, Ben-Gurion University, Beer Sheva 84105, Israel
(2) Faculty of Civil and Environmental Engineering, Technion-I.I.T., Haifa 32000, Israel
(3) Faculty of Aerospace Engineering, Technion-I.I.T., Haifa 32000, Israel
"Buckling analysis of composite panels", Composite Structures, Vol. 73, No. 2, May 2006, pp. 179-185, Special Issue: International Conference on Buckling and Postbuckling Behavior of Composite Laminated Shell Structures, doi:10.1016/j.compstruct.2005.11.052
ABSTRACT: The aim of this paper is to present the buckling analysis of a laboratory tested composite panel under axial compression by means of a simple shell finite element that is developed and presented herein. The tests were performed in the Aircraft Structure Laboratory of the Faculty of Aerospace Engineering at the Technion. Buckling is achieved via incremental geometrically nonlinear analysis and monitoring of the tangent stiffness matrix at each increment. The performance of the finite element is further validated by solving a complex multi-snap example from the literature.

Levy, R. (1) and Gal, E. (2)
(1) Faculty of Civil and Environmental Engineering, Technion—Israel Institute of Technology, Haifa 32000, Israel
(2) Structural Engineering Department, Faculty of Engineering, Ben-Gurion University, Beer-Sheva 841195, Israel

“The geometric stiffness of thick shell triangular finite elements for large rotations”, International Journal for Numerical Methods in Engineering, Vol. 65, No. 9, February 2006, pp. 1378–1402,
doi: 10.1002/nme.1491

ABSTRACT: This paper is concerned with the development of the geometric stiffness matrix of thick shell finite elements for geometrically nonlinear analysis of the Newton type. A linear shell element that is comprised of the constant stress triangular membrane element and the triangular discrete Kirchhoff Mindlin theory (DKMT) plate element is ‘upgraded’ to become a geometrically nonlinear thick shell finite element. Perturbation methods are used to derive the geometric stiffness matrix from the gradient, in global coordinates, of the nodal force vector when stresses are kept fixed. The present approach follows earlier works associated with trusses, space frames and thin shells. It has the advantage of explicitness and clear physical insight. A special procedure, tailored to triangular elements is used to isolate pure rotations to enable stress recovery via linear elastic constitutive relations. Several examples are solved. The results compare well with those available in the literature.

Erez Gal (Ben-Gurion University, Israel) and Robert Levy (Technion, Israel), “Geometrically nonlinear analysis of shell structures using a flat triangular shell finite element”, Archives of Computational Methods in Engineering, Vol. 13, No. 3, 2006, pp. 331-388, doi: 10.1007/BF02736397

ABSTRACT: This paper presents a state of the art review on geometrically nonlinear analysis of shell structures that is limited to the co-rotational approach and to flat triangular shell finite elements. These shell elements are built up from flat triangular membranes and plates. We propose an element comprised of the constant strain triangle (CST) membrane element and the discrete Kirchhoff (DKT) plate element and describe its formulation while stressing two main issues: the derivation of the geometric stiffness matrix and the isolation of the rigid body motion from the total deformations. We further use it to solve a broad class of problems from the literature to validate its use. (367 references!)