Professor B.P. Patel

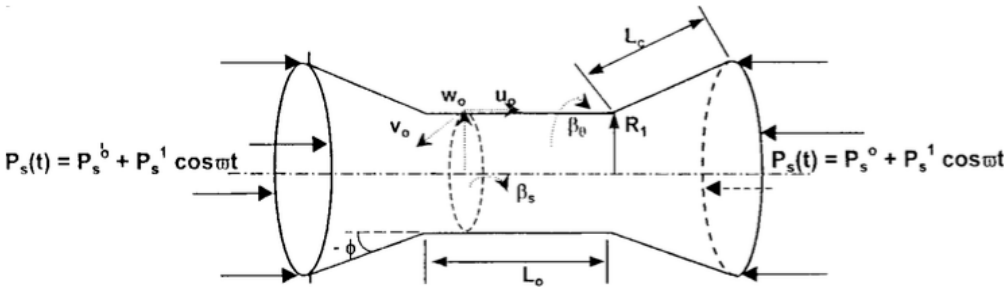

Fig. 1. Geometry and the loading of a joined conical–cylindircal–conical shell (three sections).

From: S. Kamat, M. Ganapathi and B.P. Patel, "Analysis of parametrically excited laminated composite joined conical-cylindrical shells", Computers & Structures, Vol. 79, pp 65-76, 2001

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Selected publications:

B.P. Patel, T. Nordstrand, et al, "Instability and failure of corrugated core sandwich cyhlinders under combined stress", in Multiaxial fatigue and deformation testing techniques, edited by Sreeramesh Kalluri and Peter J. Bonacuse, 1997 (cannot view publisher or abstract)

Patel, B. P., M. Ganapathi, and M. Touratier (1999). "Nonlinear Free Flexural Vibrations/Post-Buckling Analysis of Laminated Orthotropic Beams/Columns on A Two Parameter Elastic Foundation". Composite Structures 46(2), pp. 189–196.

Kamat S, Ganapathi M, Patel BP. Analysis of parametrically excited laminated composite joined conical-cylindrical shells. Comput Struct 2001;79:65–76

Ganapathi M, Patel BP, Pawargi DS. Dynamic analysis of laminated cross-ply composite non-circular thick cylindrical shells using higher-order theory. Int J Solids Struct 2002;39:5945–62.

M. Ganapathi, S. S. Gupta and B. P. Patel (Institute of Armament Technology, Girinagar, Pune 411 025, India), "Nonlinear axisymmetric dynamic buckling of laminated angle-ply composite spherical caps", Composite Structures, Vol. 59, No. 1, January 2003, pp. 89-97, doi:10.1016/S0263-8223(02)00227-1
ABSTRACT: Here, the nonlinear axisymmetric dynamic behavior of clamped laminated angle-ply composite

spherical caps under suddenly applied loads of infinite duration is studied. The formulation is based on first-order shear deformation theory and it includes the in-plane and rotary inertia effects. Geometric nonlinearity is introduced in the formulation using von Kármán's strain–displacement relations. The governing equations obtained are solved employing the Newmark's integration technique coupled with a modified Newton–Raphson iteration scheme. The load corresponding to a sudden jump in the maximum average displacement in the time history of the shell structure is taken as the dynamic buckling pressure. The performance of the present model is validated against the available analytical/three-dimensional finite element solutions. The effect of shell geometrical parameter and ply angle on the axisymmetric dynamic buckling load of shallow spherical shells is brought out.

M. Ganapathi, B. P. Patel, H. G. Patel and D. S. Pawargi (Institute of Armament Technology, GM Faculty, Girinager, Pune 411 025, India), "Vibration analysis of laminated cross-ply oval cylindrical shells", Journal of Sound and Vibration, Vol. 262, No. 1, April 2003, pp. 65-86, doi:10.1016/S0022-460X(02)01025-8
ABSTRACT: Here, free vibrations and transient dynamic response analyses of laminated cross-ply oval cylindrical shells are carried out. The formulation is based on higher order theory that accounts for the transverse shear and the transverse normal deformations, and includes zig-zag variation in the in-plane displacements across the thickness of the multi-layered shells. The contributions of inertia effect due to in-plane and rotary motions, and the higher order function arising from the assumed displacement models are included. The governing equations obtained using Lagrangian equations of motion are solved through finite element approach. A detailed parametric study is conducted to bring out the influence of different shell geometry, ovality parameter, lay-up and loading environment on the vibration characteristics related to different modes of vibrations of oval shell.

Ganapathi, M., Patel, B. P., Makhecha, B. P. Nonlinear free flexural vibration of oval rings, Journal of Applied Mechanics 70, 774-777, 2003.

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"Buckling characteristics of cross-ply elliptical cylinders under axial compression", Composite Structures, Vol. 62, No. 1, October 2003, pp. 7-17, doi:10.1016/S0263-8223(03)00079-5
ABSTRACT: Here, the elastic buckling characteristics of laminated cross-ply elliptical cylindrical shells under axial compression is studied through finite element approach. The formulation is based on higher-order theory that accounts for the transverse shear and transverse normal deformations, and incorporates realistic through the thickness approximations of the in-plane displacements. The strain-displacement relations are accurately accounted for in the formulation. The contributions of work done by applied load due to the higher-order function arising from the assumed displacement models are also incorporated. The governing equations obtained using the principle of minimum potential energy are solved through eigenvalue approach. The combined influence of higher-order shear deformation, shell geometry and elliptical cross-sectional parameter, and lay-up on the buckling loads of elliptical cylindrical shells is examined.

B. P. Patel, C. S. Munot, S. S. Gupta, C. T. Sambandam, and M. Ganapathi. Application of higher-order finite element for elastic stability analysis of laminated cross-ply oval cylindrical shells. Finite Element in Analysis and Design, 40(9-10):1083–1104, 2004.

Patel BP, Shukla KK, Nath Y. Thermal buckling of laminated cross-ply oval cylindrical shells. Compos Struct 2004;65:217–29.

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"Free vibration analysis of functionally graded elliptical cylindrical shells using higher-order theory", Composite Structures, Vol. 69, No. 3, July 2005, pp. 259-270, doi:10.1016/j.compstruct.2004.07.002
ABSTRACT: Here, the free vibration characteristics of functionally graded elliptical cylindrical shells are analyzed using finite element formulated based on the theory with higher-order through the thickness approximations of both in-plane and transverse displacements. The power law variation of properties is assumed in the thickness direction. The finite element employed in the study is based on field-consistency approach and free from shear and membrane locking problems. The strain–displacement relations are accurately introduced in the formulation without making any approximation in the thickness co-ordinate to radius ratio terms. The detailed parametric studies are carried out to study the influences of non-circularity, radius-to-thickness ratio, material composition and material profile index on the free vibration frequencies and mode shape characteristics of functionally graded elliptical shells. The significance of thickness stretch/contraction terms is highlighted through the mode shape study.

Patel, B.P., Shukal, K.K., and Nath, Y., "Thermal Postbuckling Analysis of Laminated Cross-ply Truncated Circular Conical Shells," Composite Structures, 71, 101-114, 2005.

Patel, B.P., Shukla, K.K., and Nath, Y., "Nonlinear Thermoelastic Stability Characteristics of Cross-ply Laminated Oval Cylindrical/Conical Shells," Finite Elements in Analysis and Design, 42, 1061-1070, 2006.

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(1) Department of Applied Mechanics, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110 016, India
(2) Motilal Nehru National Institute of Technology, Allahabad-211 004, India
"Thermo-elastic buckling characteristics of angle-ply laminated elliptical cylindrical shells", Composite Structures, Vol. 77, No. 1, January 2007, pp. 120-124, doi:10.1016/j.compstruct.2005.06.001
ABSTRACT: Here, the thermo-elastic buckling characteristics of angle-ply laminated elliptical cylindrical shells subjected to uniform temperature rise are studied to highlight the combined influences of non-circularity and ply-angle on the critical temperature parameter and buckling mode shapes. It is brought out that the rate of change of the critical temperature parameter with respect to ply-angle reduces significantly with the increase in the non-circularity parameter. Further the shells in the optimum ply-angle range are found to be highly sensitive to non-circularity whereas their sensitivity is very less away from the optimum ply-angle range.

S. Singh, B.P. Patel and Y. Nath (Department of Applied Mechanics, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110 016, India), "Postbuckling of angle-ply laminated cylindrical shells with meridional curvature", Thin-Walled Structures, Vol. 47, No. 3, March 2009, pp. 359-364
doi:10.1016/j.tws.2008.07.002
ABSTRACT: The influence of meridional curvature on the postbuckling behaviour of angle-ply laminated cylindrical shells subjected to external pressure, torsional load, axial compression and uniform temperature rise is investigated using the semi-analytical finite element approach. The nonlinear governing equations are solved using Newton–Raphson iterative technique coupled with the adaptive displacement control method. The presence of asymmetric perturbation in the form of a small magnitude load spatially proportional to the linear buckling mode shape is considered to trace the postbuckling path. The variation of ply-angle and ply-thickness

along the meridional direction is considered. The results presented reveal that the imperfection sensitivity of the cylindrical shells having negative Gaussian curvature decreases with the increase in the magnitude of H/r0 ratio for all the loading cases considered. The imperfection sensitivity of the positive Gaussian curvature shells increases for external pressure, torsional and thermal loading cases, whereas it decreases for axial loading case with the increase in H/r0 ratio