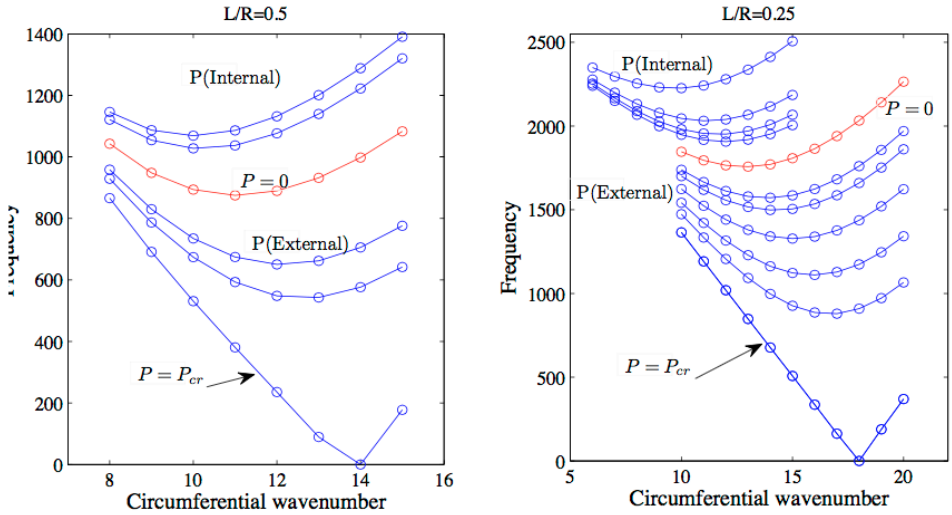
Dr. Anish Kumar



From: Anish Kumar, Sovan Lal Das and Pankaj Wahi, "Effect of radial hydrostatic loads and boundary conditions on the natural frequencies of thin-walled circular cylindrical shells", 11th International Conference on Vibration Problems, Lisbon, Portugal, 9-12 September, 2013

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Research Interests:
Dynamics of continuous systems, Shell theory, Linear and Nonlinear Vibrations of the Structures, Parametric Instability of Thin Structures.

Education:
2012(Jan) – 2016 Ph.D, Mechanical Engineering, Indian Institute of Technology Kanpur, India
2009 – 2011 M.Tech, Mechanical Engineering, Indian Institute of Technology Kanpur, India
2005 – 2009 B.Sc. Engineering, Mechanical Engineering, Muzaffarpur Institute of Technology, Muzaffarpur (B.R.A. Bihar University, Muzaffarpur), India

Selected Publications:
Anish Kumar, Sovan Lal Das and Pankaj Wahi (2016), Effect of radial external loads on the axisymmetric and asymmetric modes of vibration of the thin walled circular cylindrical shells (Manuscript under preparation).
Anish Kumar, Sovan Lal Das and Pankaj Wahi (2016), Effect of fluid loading on the dynamic behavior and stability of circular cylindrical shells (Manuscript under preparation).
Anish Kumar, Sovan Lal Das and Pankaj Wahi (2016), Static and dynamic buckling of the short cylindrical shell (Manuscript under preparation).
Anish Kumar, Sovan Lal Das and Pankaj Wahl (Indian Institute of Technology Kanpur), "Instabilities of thin circular cylindrical shells under radial loading", International Journal of Mechanical Sciences, Vol. 104, September 2015,
DOI: 10.1016/j.ijmecsci.2015.10.003

ABSTRACT: We study the stability of thin walled circular cylindrical shells subject to radial pressure loading. Towards this end, we first develop the equations of motion of these shells with predominant radial deflections. We identify additional terms in the shell equations of motion which have mostly been neglected in existing studies and ascertain their importance in predicting the correct static buckling pressure. For finite cylinders, incorporation of these terms results in the best prediction of the static buckling pressure. Furthermore, we also find that the assumed relationships between the in-plane displacements of a generic point and the in-plane displacements of the mid-surface, which change from one shell theory to the other, play a critical role in determining the correct onset of the buckling instability under radial loading. In particular, the Donnell shell theory which is very popular for the study of dynamic problems related to cylindrical shells does not predict the correct buckling pressure. We find that the Flügge-Luré-Byrne theory is best suited for this purpose. Accordingly, the shell equations with the additional terms and the in-plane displacements related as per the Flügge-Luré-Byrne shell theory have been used for the study of parametric instability of a cylinder subject to a uniform radially fluctuating pressure. Stability charts with respect to different combinations of the forcing parameters viz. the static component of the pressure, the amplitude and frequency of the fluctuating component of the pressure have been presented which can serve as design guideline for shells subject to fluctuating radial loads.

Anish Kumar, Sovan Lal Das and Pankaj Wahi (Indian Institute of Technology Kanpur), “Effect of radial loading on the beam mode vibration of circular cylindrical shells”, INCAM 2015 Conference at Indian Institute of Technology, Delhi, July 2015
ABSTRACT: In this work, we study the effect of radial loading on the beam mode vibration of circular cylindrical shells. The study has been conducted for three different boundary conditions viz. pinned-pinned, pinned-free and fixed-free. It has been observed that, the effect of external pressure on beam mode vibration of long cylinder shows a behaviour that is in contrast with other modes with circumferential wave number $n \geq 2$. However, for short cylinders it shows similar trend as the other modes $n \geq 2$. A critical length has been computed for different geometric configurations (i.e., radius and thickness), for which the effect of the external load is absent. Flügge-Luré-Byrne shell theory in conjunction with the appropriately obtained averaged shell equations of motion (nonlinear Partial Differential Equations) have been used. All results are verified with finite element analysis using ABAQUS.

Anish Kumar, Sovan Lal Das and Pankaj Wahi (Indian Institute of Technology Kanpur), “Effect of radial hydrostatic loads and boundary conditions on the natural frequencies of thin-walled circular cylindrical shells”, 11th International Conference on Vibration Problems, Lisbon, Portugal, 9-12 September, 2013
ABSTRACT: Cylindrical shells are widely used in industrial applications. During operation, these cylindrical shells are subjected to radial as well as axial loads, which alter the natural frequencies of these structures. These loads might have a fluctuating component along with a mean value. To avoid the phenomenon of resonance due to the fluctuating component, the variation of the natural frequencies with the mean load needs to be taken into account. In this paper, the variation of the natural frequencies associated with the various circumferential wavenumbers with the mean radial hydrostatic loads load has been studied. This study also helps in identifying the circumferential wavenumber associated with the lowest natural frequency for a given radial load. Static buckling load for the cylindrical shells where the lowest natural frequency becomes zero is also obtained as a special case. The study has been performed for four different types of boundary conditions viz. pined-pined, pined-free, clamped-free, and clamped-clamped. Flugge-Lur'e-Byrne shell theory in conjunction with the appropriately obtained averaged equations of motion (nonlinear PDEs) has been used for the present analysis. These nonlinear PDEs are first linearized about the steady solutions corresponding to the mean load and then

converted into system of ODEs using Galerkin projections with appropriate mode shapes. These ODEs are used to obtain the natural frequencies for different circumferential and axial wavenumbers. Our studies show that the circumferential wavenumber corresponding to the lowest natural frequency is strongly affected by the radial load especially for lower slenderness ratios for all boundary conditions. Increase in the magnitude of an inward radial load decreases the natural frequencies but results in an increase in the circumferential wavenumber corresponding to the first fundamental mode. The situation is reversed for an outward radial load but the effect is less pronounced. In this paper, further study has been made on the variation of natural frequency with hydrostatic pressure. These results have been verified against FEA results obtained using ABAQUS.

Kumar, A., Das, S., Wahi, P.: Dynamic buckling of thin-walled circular cylindrical shells subject to fluctuating radial loads, SMiRT Conference, New Delhi, India, 2011.