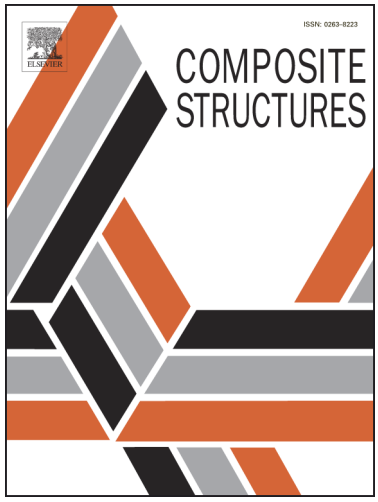

Three-dimensional hygrothermal vibration of multilayered cylindrical shells

Tiangui Ye, Guoyong Jin, Siyang Gao

PII: S0263-8223(18)30911-5
DOI: https://doi.org/10.1016/j.compstruct.2018.06.055
Reference: COST 9849

To appear in: *Composite Structures*

Received Date: 6 March 2018
Revised Date: 24 May 2018
Accepted Date: 15 June 2018

Please cite this article as: Ye, T., Jin, G., Gao, S., Three-dimensional hygrothermal vibration of multilayered cylindrical shells, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.06.055

Three-dimensional hygrothermal vibration of multilayered cylindrical shells

Tiangui Ye[1*], *Guoyong Jin*[1], *Siyang Gao*[2]
[1]*College of Power and Energy Engineering, Harbin Engineering University, Harbin, PR China, 150001*
[2]*No.703 Research Institute of CSIC, Harbin, PR China, 150001*

Abstract

The rise in moisture concentration and temperature reduces both strength and stiffness of composites. A thorough understanding of the effects of temperature and moisture concentration in composite structures is critical in ensuring safety design. There seems to be no such solutions available for multilayered composite cylindrical shells. This paper is therefore devoted to the three-dimensional hygrothermal vibration analysis of multilayered cylindrical shells under general boundary conditions for the first time. The formulation is based on the 3-D elasticity theory. The vibrational displacement field is numerically discretized by the sampling surface technique in the transfer domain and approximated by the spectral method in the remaining domains. The transverse deformations and interlaminate continuities are taken into account in combination with differential-quadrature concept. The governing equations are finally derived in a modified variational form for constrained system and the boundary conditions are taken into account in a unified form by utilizing penalty functions and Lagrange multipliers. The boundary conditions may be free, simply-supported, clamped or/and elastically restrained. The solutions match well with those reported in the literature in verification. The effects of hygrothermal environment, boundary conditions, shell geometry, lamination are brought out and discussed through parametric study.

Keywords: vibration; multilayered cylindrical shells; hygrothermal environment; spectral-sampling surface method; general boundary condition

* Corresponding author: Tel./fax: +86 451 82589199; E-mail: yetiangui@gmail.com & yetiangui@hrbeu.edu.cn