11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

DELAMINATION MODELING IN SHELLS BY MEANS CUF FINITE ELEMENTS

Keshava Kumar S.[1], Maria Cinefra[2] and Erasmo Carrera[3]

[1] Ph.D Student, Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India, keshav@aero.iisc.ernet.in

[2] Research Assistant, Aerospace Engineering Department, Politecnico di Torino, Corso Duca degli Abruzzi, 24 10129, Torino, Italy, maria.cinefra@polito.it

[3] Professor, Aerospace Engineering Department, Politecnico di Torino, Corso Duca degli Abruzzi, 24 10129, Torino, Italy, erasmo.carrera@polito.it

Key words: *Carrera Unified Formulation, Shells, Delamination, Eigenvalues.*

Delamination in the composite structure may occur either during the manufacturing process or during service period of the structure. Delaminations can be distinguished into two types, one delamination at the free edges caused by high free edge stresses, and the other embedded within the body of the structure which may be due to manufacturing defects or voids, or due to impact loads. To facilitate understanding of effect of delamination on structures, and analyze possible algorithms for structural health monitoring of delaminated structures, delamination models are required.

Several authors have studied delaminated shells, like Nanda and Sahu have carried out free vibration analysis of delaminated composite shells [1] using different shell theories. Dynamic instability of delaminated skew plates subjected to static and dynamic loads based on higher order shear deformation theory was carried out by Noh and Lee [2]. These studies used a single theory or couple of theories to carry out there studies. The proposed investigation tries to comprehensively carry out free vibration analysis of delaminated composite shells for most of the theories using refined and advanced shell models, contained in the Carrera's Unified Formulation (CUF). The CUF permits to obtain, in a general and unified manner, several models that can differ by the chosen order of expansion in the thickness direction, by the equivalent single layer or layer wise approach and by the variational statement used [3]. By implementing delamination model in the CUF frame-work, analysis of delaminated structures can be carried out using several models.

The complete article will tabulate results of delaminated cylindrical shell from various theories and the results will be validated with the existing literature. First few modeshapes of the shell will be ploted. Effect of delamination size and the stacking sequence on the natural frequencies of the shell will be studied.

REFERENCES

[1] Namita Nanda and S.K. Sahu. Free vibration analysis of delaminated composite shells using different shell theories, *International Journal of Pressure Vessels and Piping*, Vol. **98**, 111–118, 2012

[2] Myung-Hyun Noh and Sang-Youl Lee. Dynamic instability of delaminated composite skew plates subjected to combined static and dynamic loads based on HSDT, *Composites Part B: Engineering*, Vol. **58**, 113–121, 2014

[3] Maria Cinefra. *Refined and advanced shell models for the analysis of advanced structures*, PhD thesis, Politecnico di Torino, 2012