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

AXIOMATIC/ASYMPTOTIC ANALYSIS OF REFINED MODELS FOR THERMAL STRESS ANALYSIS OF PLATES

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Key Words: *Unified Formulation, Plate, Thermal Stress Analysis, Axiomatic/Asymptotic Technique.*

ABSTRACT

Refined models for thermal stress analysis of multilayered plates are the subject of this work. The Carrera Unified Formulation is used in order to generate refined models of any order. Both the Equivalent Single Layer (ESL) and the Layer Wise (LW) schemes are adopted. A Navier-type solution is employed and simply supported orthotropic plates are considered. The temperature distribution along the thickness direction is defined in two different manners. In some cases, a linear temperature distribution is assumed. In other cases, the temperature distribution is computed by solving the Fourier heat conduction equation ([1,2]).

The purpose of this survey is to define reduced refined models able to provide the same accuracy of full refined models with a lower computational cost. The axiomatic/asymptotic technique is employed ([3]). This technique is based on the measurement of the relevance of each displacement variable. The displacement variables of the full refined model are deactivated one at a time and the error, due to their deactivation, is measured with respect a reference solution. A variable is considered as not relevant if the error committed with its suppression is lower an a-priori defined threshold.

The reduced refined models are obtained for different stress/displacement components. The effectiveness of each displacement variable is measured considering the influence of several parameters, such as the length-to-thickness ratio (a/h), stacking sequence and the kind of material (isotropic or orthotropic). Two different criteria are proposed to compute the error.

It has been found that the relevance of each displacement variable is strongly affected by the problem considered. Furthermore, for a given problem the reduced models have been constructed considering once a thermal and once a mechanical load. It has been demonstrated that the nature of the load (mechanical or thermal) leads to retain different displacement variables.

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