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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures 1 - Development and Verification (Space Vehicles and Components) (1)

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STANDARD FEM VALIDATION CHECKS AND QUALITY OF RESPONSE PREDICTION

Abstract

Mathematical models (Finite Element Models) of the satellites structures are validated via a correlation process with results from dynamic test campaigns. Typically the modal assurance criterion (MAC) and normalised cross orthogonality (NCO) are used to quantify the quality of the match between models predictions' and test results, and appropriate thresholds are set to insure that a model that passes the test gives sufficiently good prediction of the behaviour of the real structure. However these criteria focus on comparing mode shapes, and the results of this correlation can be misleading. Undoubtedly if an excellent correlation is achieved (e.g. MAC very close to unit value) the modal model is an excellent representation of the real structural behaviour; but most often there are models where MAC or NCO is just below the threshold and these are deemed not fit for purpose and requiring some FE model updating to push them above the validation threshold. The main contribution of this work is to show with practical examples ore real spacecraft FEMs that a model that passes MAC and NCO checks is not necessarily better at predicted some of the relevant structural responses (e.g. reactions at the base of the craft) than a model that does not pass the check. The examples show that some of the responses are highly uncorrelated with MAC and NCO results and therefore the temptation to extrapolate the results of these validation checks to the "quality" of the model – quality intended in terms of model's capability to predict relevant responses – should be rejected. The work follows two Monte Carlo approaches, which are then validated against each other.