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A MEDIUM-FREQUENCY WIDE BAND ANALYSIS FOR SHALLOW SHELL STRUCTURES

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Nowadays the interest of the aerospace and automotive industries on the medium-frequency vibration problems is increasing more and more. Since a predictive software capable of evaluating such vibrational behaviour can drastically reduce time and costs of the experiments required, its development is becoming one of their major concerns. Nevertheless, the development of such software is still an open question in the scientific research domain because the classical methods (i.e. FEM, SEA) are not suitable for the medium-frequency bandwidth.

In this context the Variational Theory of Complex Rays (VTCR) [1] is catching on as an *ad-hoc* method to tackle medium-frequency problems. It is a fixed-frequency Trefftz method based on a weak variational formulation which allows great flexibility because any shape function, provided that it satisfies the governing equations, can be used. Moreover the approximations within the substructures are *a priori* independent of one another. In order to calculate the bandwidth response the method has already been successfully coupled with the Proper Generalized Decomposition (PGD) technique using its Fourier version in the acoustic domain [2].

The PGD method [3, 4]is a model reduction technique which builds up the entire solution directly in the separate variables representation (frequency-space domain). This permits to use much less frequency steps than a common interpolator with a consistent spare of computational resources.

In the structural domain the equations are more complex and the implementation of the Fourier version of the VTCR is difficult. On the other hand its rays version fits perfectly in the vibration environment. Unfortunately this version has some ill-conditioning issues that forbid a *straight forward* combination with the PGD technique. Our strategy will overcome such ill-conditioning issues using an iterative solver.

The aim of this work is the prediction of the vibration response of a shallow shell structure over a medium-frequency band. At first the frequency band is discretized and the VTCR is calculated for each frequency step. After that the problem is regularized and, in the end, the PGD is applied. A relevant numerical example is presented to show the strategy.

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