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Abstract

The application of composite materials in marine propellers is a relatively recent innovation. Methods have been presented to analyse the hydro-elastic behaviour of these type of propellers and in some studies these methods have been validated as well. Differences between measured and predicted responses are typically explained from inaccuracies in structural or fluid modelling. It is beyond all doubt that for an accurate finite element (FE) model a correct modelling of the fibre orientations and material properties is required. Both subjects are addressed in this work. An approach is presented in order to accurately define the element dependent fibre orientations in doubly curved geometries like (marine) propeller blades. In order to improve the structural response prediction this paper presents an inverse method based on experimental and numerical results which can be used for structural identification and FE model updating. In the developed approach the residual between measurement results obtained with static experiments and results obtained with an FE model is minimized by adapting the stiffness properties in the FE calculation. This method has been successfully applied to two small scale composite propellers. The obtained material properties have been determined with a relatively high confidence level. A verification by means of measured and calculated eigenfrequencies show also that accurate results are obtained with the inverse method. Therefore, this paper gives a positive answer on the research question whether it is possible to determine the stiffness properties of small scale composite marine propeller blades from a static experimental data.

Keywords: Composite Propellers, Finite Element Modelling, Model Updating