COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

Numerical Simulation of Composite Ship under Hydrodynamic load using Fluid Structure Interactions

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Composite sandwich material is playing an important role in ship structure construction. Structural analysis of a composite multi-hull structure has been performed using finite element analysis (FEA). Two-way fluid structure interaction (FSI) is implemented by coupling FEA with computational fluid dynamics (CFD). Hull structure is made of sandwich construction having composite face sheets and PVC foam core. The finite element catamaran model was built in ANSYS workbench. In CFD code CFX, fluid domain was created and wave motion was simulated based on Sea State 5. Hydrodynamic load was therefore generated in the CFD code. FSI module was then used to connect FEA with CFD module by transferring load and displacement back and forth. Dynamic response of the hull in time domain was generated. A critical area with high stress gradient was chosen and a sub model with refined mesh and layered composite configuration was developed. Force and displacement boundary conditions were transported to the sub model from the global model. Interlaminar stresses and shear stress distribution at the core and girder were then determined. Materials failure criteria for composites and foam were applied on the sub model and structural integrity of each component was checked.