Modeling of Crack Propagation on
Ship-Hull Panels Using Coupled PD-IGA Method

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ABSTRACT

In this research, we develop a coupled isogeometric-peridynamics (IGA-PD) method that can model crack propagation on curve plates such as ship-hull panel. Peridynamics (PD) method is recognized as one of the best methods to simulate dynamic crack propagation. However, PD method is very time consuming due to its requirement of using fine mesh and intensive nodal search. To build a method that's efficient and accurate, we use PD method only to describe crack opening area. For the other regions, we use IGA first-order shear deformation theory to speed up the calculation and ensure the accuracy of geometry. In the coupling region, we tested both the penalty method and Nitsche's method for applicability. For the penalty method, we introduced the assumed shape function to interpolate the PD displacement on the interface. And for the Nitsche's method, the stress tensor of PD is calculated, and then the assumed shape function is used to connect with the IGA domain. Finally, in the numerical calculation, we test our proposed method for crack propagation on both flat panel and the curved panel.

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