

Numerical Study of Fatigue Crack Growth at a Web Stiffener of Ship Structural Details

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Abstract : It is necessary to manage the fatigue crack growth (FCG) once those cracks are detected during in-service inspections. In this paper, a simulation program (FCG-System) is developed utilizing the commercial software ABAQUS with its object-oriented programming interface to simulate the fatigue crack path and to compute the corresponding fatigue life. In order to apply FCG-System in large-scale marine structures, the substructure modeling technique is integrated in the system under the consideration of structural details and load shedding during crack growth. Based on the nodal forces and nodal displacements obtained from finite element analysis, a formula for shell elements to compute stress intensity factors is proposed in the view of virtual crack closure technique. The cracks initiating from the intersection of flange and the end of the web-stiffener are investigated for fatigue crack paths and growth lives under water pressure loading and axial force loading, separately. It is found that the FCG-System developed by authors could be an efficient tool to perform fatigue crack growth analysis on marine structures.

Keywords : crack path, fatigue crack, fatigue live, FCG-system, virtual crack closure technique

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