Abstract

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Assessing the Risk of Ship Hull Collapse due to Collision

This study proposes a method for assessing the risk of ship hull collapse following a collision. A probabilistic approach is applied to establish the relationship between the exceedance probability of collision versus the residual ultimate longitudinal strength index. A set of credible collision scenarios which represent the entire range of possible collision accidents is Selected using a sampling technique based on probability density distributions of influencing parameters. The amount and location of collision damage for Selected individual collision scenarios are characterised using the LS-DYNA nonlinear finite element method. The ultimate hull girder strength of a ship with predefined collision damage is then calculated using the ALPS/HULL intelligent supersize finite element method. To demonstrate the applicability of the proposed method, applied examples are given, involving collisions with a hypothetical Suezmax-class double-hull oil tanker. Based on the results, design formulations for predicting the residual strength index of damaged ship hulls are derived in an empirical manner. The examples show that the proposed method will be very useful for evaluating the risk of collapse of a ship's hull after sustaining collision damage, which may contribute to a collision risk-based design (RBD) framework. Moreover, the method will be useful in rescue and salvage operations immediately after a collision by permitting a rapid assessment of the structural safety of a damaged ship.