

Abstract

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Quantitative Risk Assessment for Collisions Involving Double Hull Oil Tankers

In recent decades, the safety of ships at sea has become a major concern of the global maritime industries. Ships are rarely subject to severe accidents during their life cycle. Collision is one of the most hazardous accidents, with potentially serious consequences such as the loss of human life, structural damage and environmental damage, especially if large tankers, LNG and/or nuclear-powered vessels are involved. This study presents a Quantitative Risk Assessment (QRA) for double hull oil tankers that have collided with different types of ships. The methodology used to perform the QRA is based on the International Maritime Organization's (IMO) definition of a Formal Safety Assessment (FSA). Using probabilistic approaches, ship-ship collision scenarios are randomly Selected to create a representative sample of all possible scenarios. The collision frequency is then calculated for each scenario. As this is a virtual experiment, the LS-DYNA nonlinear finite element method (NLFEM) is used to predict the structural consequences of each scenario Selected. In addition, the environmental consequences are estimated by calculating the size of each scenario's oil spill. To assess the economic consequences, the property and environmental damages are calculated in terms of monetary units. The total risk is then calculated as the sum of the resultant structural and environmental damages. Exceedance curves are established that can be used to define the collision design loads in association with various design criteria.