Design optimization of piping arrangements in series ships based on the modularization concept

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Abstrak

The shipbuilding industry is currently operating in a state of intense market competition. In order to compete in the global market, shipbuilders must produce ships that are more efficient and which can be constructed in a relatively short turnaround time between order placement and delivery. This necessitates the development of new methods such as the building of series of ships, design optimization, and the modularization concept. This paper presents a design optimization approach based on the modularization concept for engine room design. The proposed method focuses on the following characteristics: piping systems, employed in multiple bulk carrier-series ships, of different sizes. Consideration is given to the cost and weight of these systems and the similarity and common features of the modules and arrangements concerned. The piping system design process is divided into two stages—module definition and arrangement design. A design structure matrix is adopted to define an effective module that could be employed for use in the design of various series of ships. An optimization system has been developed for use in the arrangement design stage. It uses a genetic algorithm to obtain a similar pattern for module arrangement in various series of ships, with specific consideration extended to cost and similarity. The details of the proposed method are discussed in this paper. In addition, the paper discusses the piping system design of an actual ship by using the proposed method and evaluates its effectiveness.