Ship Cabins Acoustic Layout Optimization with the Hungarian Algorithm

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Abstract: New strict standards and codes for noise level specification in ships will be adopted in 2014 by IMO (International Marine Organization). The current noise reduction design methods can not meet the requirements on lower noise level in cabins for ship design. It is beneficial to control cabin acoustics performance during the overall design of ship, the so called cabin acoustic layout optimization design. Rarely research on cabins acoustic layout optimization has been conducted in the past decades. The difficulties lie in the lack of fast calculation software for cabins sound pressure level, the complexity in optimization model description with quantity design variables, and the solving methods. In this paper, the optimization model for ship cabins acoustics layout optimization, namely how to assign each working/navigation/living space to the ship cabins, is established. The model minimizes the sum-of-squared differences between the upper sound pressure limit of the working/navigation/living space and the calculated sound pressure of the cabins, the matching relationships were defined as decision variables which are binary variables, the special requirements like positions of some cabins and sound pressure level for cabins were chosen as behavior constraints. The problem is transformed into the standard form of assignment problem, then the Hungarian algorithm is applied to solve the model. The layout optimization examples with different constraints are studied. Optimization results show the proposed model is easy to understand, apply and of high efficiency.

Keywords: Layout optimization; Acoustics; Hungarian algorithm; Acoustic criterion;

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