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Thermohydroacoustic analysis of an underwater vessel

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Abstract

Underwater vessel is one the most important naval equipments, especially from the defence point of view. Therefore, Camouflage of these vessels is a key factor in their survival. Thermal noise and hydroacoustic noise are two major noises of underwater vessels. As a result, in this paper, these noises are investigated around an underwater vessel body with three different speeds. To this end, thermohydroacoustic analyses are conducted using the Navier-stokes and heat transfer equations. In addition, Ffowcs Williams and Hawkings model are implemented to obtain sound pressure level in far field. Ansys-CFX solver is used to compute the Navier-stokes and heat transfer equations and a parallel processing code in Python named AcoPy is prepared for calculating the sound pressure level. Thermal radiation intensity and sound pressure level (SPL) characteristics are evaluated for thermal noise and hydroacoustic noise, respectively. The obtained Results have shown that change in speed does not have any significant effects on the thermal noise. Also, increase of hot wake behind the underwater vessel with enhancement of its radiation intensity is achieved by an increase in the vessel speed. On the other hand, thermohydroacoustic analysis has shown non-uniform pressure and velocity distribution at Reynolds number $Re=45\times10^6$.

Keywords: Thermal noise, Hydroacoustic noise, Underwater vessel, Parallel processing.

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