Development and Mesh Guidelines of the Acoustics Overlapping Mesh Technique

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Having accurate and affordable methods to predict the underwater radiated noise of ships facilitates the development of effective noise control techniques. The acoustic overlapping mesh (AOM) technique, which enables the direct integration of volumetric noise terms in the Lighthill and FWH acoustic analogies, is regarded as a promising way to obtain such a method. In this work, the development of AOM technique will be described. The recent improvements and verification of the AOM technique will also be presented. These include extending the overlapping mesh idea to the surface noise terms, further reducing the acoustic computational burden. Meanwhile, three causes for numerical discrepancies of the AOM technique are identified and analysed theoretically and numerically, leading to preliminary guidelines for choosing the acoustic mesh dimensions. The results suggest that keeping the distance-to-cell-size ratio (r/h) larger than 7.97 helps maintain the discrepancies from two causes (Cause-II and Cause-III) less than 1dB. Keeping the cell-size-to-wavelength ratio (h/λ) lower than 0.05 avoids a sharp increase of the rest discrepancy (Cause-I), and keeping it lower than 0.005 helps maintain that part of discrepancy less than 1dB. The simulation cases also show that the AOM technique reduces the acoustic computational time by more than 99% and 90% for the total and surface noise, respectively, while maintaining a discrepancy of around 1dB. Using a non-uniform acoustic mesh instead of the uniform one helps achieve a discrepancy of around 0.1dB with a similar acoustic computational time.