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A combined CFD-FEM approach to evaluate acoustic performances of an integrated scrubber-silencer for marine applications

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In recent years, green shipping becomes one of the fundamental challenges for the marine industry: the limits imposed on ship emissions by IMO (International Maritime Organization) are increasingly stringent, especially in terms of SOx (sulfur oxides). The installation on board of scrubbers has proved to be a helpful solution to SOx abetment, in particular for the ships already in navigation: it allows to respect the limits imposed by the IMO even with the use of HFOs (Heavy Fuel Oils), so without the need to carry out a complete refitting of the propulsion system. However, such systems, usually installed in the funnels, have large dimensions. The integration between components is the best method to optimize the spaces, facilitating the installation of the scrubbers on board. The present work investigates a combined CFD-FEM (Computational Fluid Dynamics-Finite Element Method) methodology to evaluate the acoustic performances of a model-scale scrubber. Some papers in the literature consider the acoustic properties of SCRs (Selective Catalytic Reduction systems) for marine applications, while a thorough study on scrubbers' performances is missing. Independent CFD or FEM calculations may evaluate the acoustic properties of the scrubber. However, the combined methodology reduces the computational burden by about 90% compared to the CFD modelling. Moreover, it gives the advantage of considering the influence of flow on acoustic properties, which is impossible for a fully FEM approach.

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