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Comparison between microscopic and macroscopic models of porous materials in aerodynamic sound generated from a flow past a cylinder YUJI HATTORI, Institute of Fluid Science, Tohoku University, YASUNORI SATO, GSIS, Tohoku University — Covering rigid bodies in high-speed flows with porous materials is one of the promising methods for reduction of aeroacoustic noise. In order to optimize the shape and porosity of the porous materials, numerical methods that can accurately predict the aeroacoustic sound generated in a flow involving rigid bodies and porous materials are expected. We study the aeroacoustic sound generated from a flow past a cylinder which is covered by porous materials. Two models are compared: (i) the microscopic model in which the porous materials are modeled by collection of small cylinders and (ii) the macroscopic model in which continuous modeling like Darcy's law are employed. The compressible Navier-Stokes equations are solved numerically with high-precision methods to obtain the sound pressure directly. In both models the acoustic power is reduced to 0.1% of that of a bare cylinder for optimized parameters. The results obtained by the two models are linked by the theory of Carman-Kozney, showing that the macroscopic model can be used for prediction of the aeroacoustic sound.

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