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Evaluation of the accuracy of the Rotating Parallel Ray Omnidirectional Integration for instantaneous pressure reconstruction from the measured pressure gradient[1] JOSE MORETO, XIAOFENG LIU, San Diego State University — The accuracy of the Rotating Parallel Ray omnidirectional integration for pressure reconstruction from the measured pressure gradient (Liu et al., AIAA paper 2016-1049) is evaluated against both the Circular Virtual Boundary omnidirectional integration (Liu and Katz, 2006 and 2013) and the conventional Poisson equation approach. Dirichlet condition at one boundary point and Neumann condition at all other boundary points are applied to the Poisson solver. A direct numerical simulation database of isotropic turbulence flow (JHTDB), with a homogeneously distributed random noise added to the entire field of DNS pressure gradient, is used to assess the performance of the methods. The random noise, generated by the Matlab function Rand, has a magnitude varying randomly within the range of $\pm 40\%$ of the maximum DNS pressure gradient. To account for the effect of the noise distribution pattern on the reconstructed pressure accuracy, a total of 1000 different noise distributions achieved by using different random number seeds are involved in the evaluation. Final results after averaging the 1000 realizations show that the error of the reconstructed pressure normalized by the DNS pressure variation range is 0.15 ± 0.07 for the Poisson equation approach, 0.028 ± 0.003 for the Circular Virtual Boundary method and 0.027 ± 0.003 for the Rotating Parallel Ray method, indicating the robustness of the Rotating Parallel Ray method in pressure reconstruction.

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