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Rotating parallel ray omni-directional integration for instantaneous pressure reconstruction from measured pressure gradient[1] XIAOFENG LIU, SETH SIDDLE-MITCHELL, San Diego State University — This paper presents a novel pressure reconstruction method featuring rotating parallel ray omni-directional integration, as an improvement over the circular virtual boundary integration method introduced by Liu and Katz (2003, 2006, 2008 and 2013) for non-intrusive instantaneous pressure measurement in incompressible flow field. Unlike the virtual boundary omni-directional integration, where the integration path is originated from a virtual circular boundary at a finite distance from the real boundary of the integration domain, the new method utilizes parallel rays, which can be viewed as being originated from a distance of infinity, as guidance for integration paths. By rotating the parallel rays, omni-directional paths with equal weights coming from all directions toward the point of interest at any location within the computation domain will be generated. In this way, the location dependence of the integration weight inherent in the old algorithm will be eliminated. By implementing this new algorithm, the accuracy of the reconstructed pressure for a synthetic rotational flow in terms of r.m.s. error from theoretical values is reduced from 1.03% to 0.30%. Improvement is further demonstrated from the comparison of the reconstructed pressure with that from the Johns Hopkins University isotropic turbulence database (JHTDB).

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Xiaofeng Liu
San Diego State University

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