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Advances in Magnetic Resonance Velocimetry and the 2019 MRV Challenge

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Magnetic resonance imaging is a leading technique to measure velocity fields in geometrically complex flows. Two recent examples include three-component, phase-locked measurements within rotating turbomachines and 3D velocity field measurements throughout model urban canopies. Advances in scanner hardware, pulse sequences, and post-processing techniques are providing improvements in spatial and temporal resolution with reductions in total scan time and measurement uncertainty. However, there are no agreed upon best practices for measuring mean velocity fields in turbulent flows. The 2019 MRV Challenge addresses this issue. Multiple groups are measuring the velocity field in a specific flow configuration consisting of a square cross section U-bend operated at a Reynolds number of 15,000. This configuration produces strong mean velocity profile distortion and pressure-driven secondary flows posing a significant challenge to any measurement technique. The entire apparatus including the flow development section and the U-bend is shipped from lab-to-lab insuring uniformity of test conditions. The specific measurement techniques used by various groups and a comparison of the data sets will be presented in this focus session.