Abstract Submitted
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4D Flow MRI Bias Error Estimation[1] SEAN ROTHENBERGER, Weldon School of Biomedical Engineering, Purdue University, JIACHENG ZHANG, MELISSA BRINDISE, School of Mechanical Engineering, Purdue University, SUSANNE SCHNELL, Feinberg School of Medicine, Northwestern University, PAVLOS VLACHOS, School of Mechanical Engineering, Purdue University, VITALIY RAYZ, Weldon School of Biomedical Engineering, Purdue University — 4D flow MRI is a non-invasive imaging technique providing time-resolved, volumetric, 3-directional velocity information of a patient's cardiovascular flow in vivo. This technique suffers from low VNR and resolution. 'Enhanced' 4D flow MRI measurements can be produced by informing the measurements with high-resolution flow modeling methods, e.g. CFD, PIV. However, the error of the 4D flow MRI measurements must first be defined. Past literature defines a model for measurement error, but neglects bias error. This study estimates bias error by integrating an approximated intravoxel velocity profile within the limits of the voxel dimensions. The model of bias error was tested in synthetic flow with a velocity range of 2m/s. The effect of the voxel size and noise was determined by investigating a range of voxel sizes and noise standard deviations of 1 to 0.147mm^3 and 0 to 6cm/s, respectively. The estimates were compared to the true bias error calculated using the true velocity profile. Results show that the bias error is proportional to the square of the voxel size. The estimated bias error was determined to be fourth-order accurate when the RMS difference was compared to the change in voxel size. The bias error estimate is proportional to the square of the noise's standard deviation.

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Sean Rothenberger
Weldon School of Biomedical Engineering, Purdue University

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