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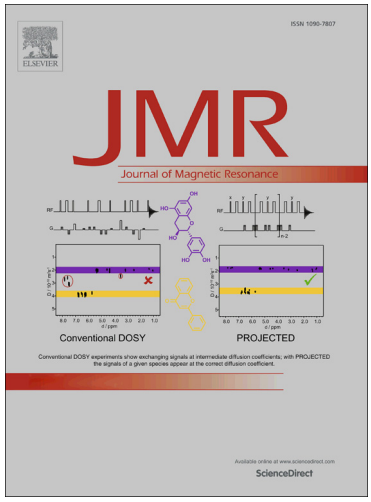

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Quantitative Velocity Distributions via Nuclear Magnetic Resonance Flow Metering

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Abstract

We demonstrate the use of Tikhonov regularisation as a data inversion technique to determine the velocity distributions of flowing liquid streams. Regularisation is applied to the signal produced by a nuclear magnetic resonance (NMR) flow measurement system consisting of a pre-polarising permanent magnet located upstream of an Earth's magnetic field NMR detection coil. A simple free induction decay (FID) NMR signal is measured for the flowing stream in what is effectively a 'time-of-flight' measurement. The FID signal is then modelled as a function of fluid velocity and acquisition time, enabling determination of the velocity probability distributions via regularisation. The mean values of these velocity distributions were successfully validated against in-line rotameters. The ability to quantify multi-modal velocity distributions was also demonstrated using a two-pipe system.

Keywords

NMR, flow meter, velocity distribution, Tikhonov regularisation

Destination

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