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Contactless Inductive Flow Tomography: Theory and Experiment

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When a moving electrically conducting fluid is exposed to an applied magnetic field, electrical currents are induced that give rise to an additional magnetic field. The ratio of the induced field to the applied field is determined by the magnetic Reynolds number Rm. If Rm is not too small, the induced field can be measured in the exteriour of the fluid. Applying the imposed magnetic fields in different directions and measuring the respective induced fields one can gather sufficient information to reconstruct, at least approximatively, the velocity structure of the fluid. The theory of such a ontactless inductive flow tomography (CIFT) is delineated, and its practical feasibility is demonstrated in a liquid metal experiment. Qualitative as well as quantitative changes of the flow field were resolved by the CIFT method in a reasonable and reproducible way.

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