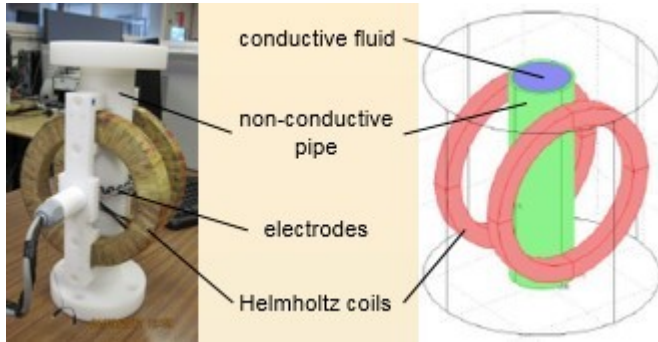
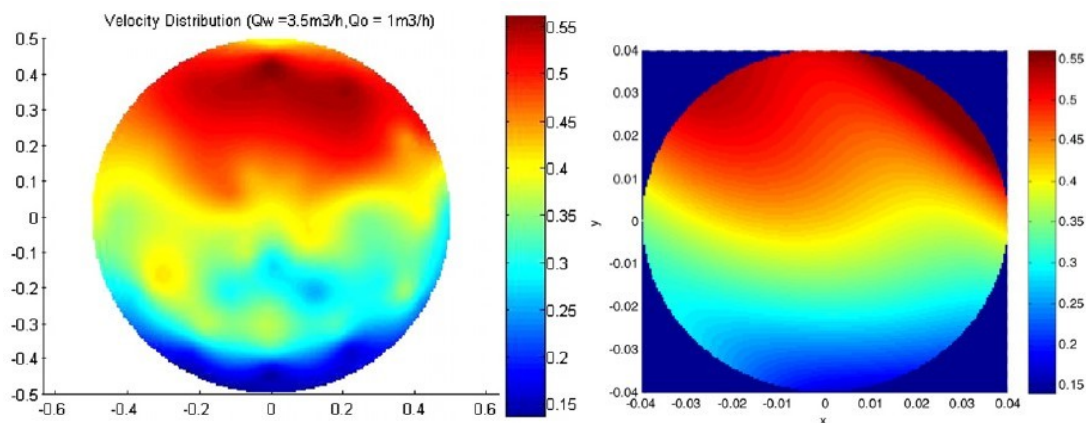


Development of methods for reconstruction of velocity profiles using an electromagnetic flow meter



Conventional electromagnetic flow meters (EMFMs) can provide accurate measurements of the volumetric flow rate of conducting fluids in axisymmetric flows. The applicability of EMFMs can be extended to measure flow rate accurately in stratified flows by adding further pairs of electrodes. However, the challenge is to predict not only a

volumetric flow rate or mean flow velocity, but a velocity distribution. An analytical method based on the discrete Fourier transform (DFT) has been developed for the reconstruction of velocity profiles in a circular pipe using potential distributions measured by a multi-electrode electromagnetic flow meter. The velocity profile is composed by axisymmetric and polynomial components as a function of the spatial coordinates. The technique is applicable for both axisymmetric and stratified flows. It requires two measurements of the boundary potential distribution: one measurement in a uniform magnetic field, and another one in a non-uniform magnetic field. The application of the DFT on the potential distribution measured in the uniform magnetic field provides possible velocity profiles as a superposition of polynomial components up to 6th order. The application of the DFT on the potential distribution measured in the non-uniform magnetic field predicts the axisymmetric velocity profile; and it is also used to choose the optimum velocity profile among the possible solutions.



Original (measured formerly in a two-phase flow) and reconstructed velocity profiles

Further challenges are to extend the method to reconstruct velocity profiles in annular flows and slug flows, and to consider the non-constant conductivity of the fluid flowing in the pipe section. The method developed is applicable to measure the velocity of a conductive single-phase fluid, and that of a conductive carrying phase in two-phase flows and in channels inside circular sections, e.g. in blood-vessels in human limbs.

Selected publications on the topic

1. Kollar, L. E., Lucas, G. P., Zhang, Z., Proposed Method for Reconstructing Velocity Profiles Using a Multi-Electrode Electromagnetic Flow Meter, *Measurement Science and Technology*, Vol. 25, No. 7, 14pp, 2014.
2. Kollar, L. E., Lucas, G. P., Zhang, Z., An Analytical Method for Reconstruction of Velocity Profiles using a Multi-Electrode Electromagnetic Flow Meter, *Proc. 7th World Congress on Industrial Process Tomography (WCIPT7)*, pp. 385-394, Krakow, Poland, 2013.