Complex Flows in Curved Pipes
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Curved geometries are present in natural, biological and mechanical flow systems, e.g. river banks, the aortic arch as well as the exhaust manifold of the internal combustion engine. Furthermore most of the systems, which are comprised of bended sections, operate under turbulent flow conditions and in many cases an additional motion is superposed on the steady flow. For example, the flow in the car engine is known to be highly pulsating while in systems where a fan or cyclone exists, swirling flows can be generated. Despite their great importance for their prevalence both in nature and in industry, turbulent flows with or without pulsations or swirl have only been studied to a very limited extent.

Here we investigate – by means of hot/cold-wire anemometry, laser Doppler velocimetry and particle image velocimetry – turbulent flows through both straight and curved pipes under steady conditions with and without a superposed swirling motion and flows under highly pulsating conditions. Decomposition techniques have been particularly utilised in order to extract the large-scale structures present in such flows which are – among others – prevalent in the exhaust manifold of the internal combustion engine.