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Secondary motions induced by a 90° bend in turbulent pipe flow[1]

LEO HELLSTRÖM, ALEXANDER SMITS, Princeton University — Continuous stereoscopic particle image velocimetry (SPIV) was used to investigate the temporal behavior of curvature induced motions downstream a 90° bend in fully developed turbulent pipe flow. The velocity field was fully resolved in time for Reynolds numbers ranging from 1.3×10^4 to 3.6×10^4. Snapshot Proper Orthogonal Decomposition was performed on the data to extract the most energetic modes in the flow, which are believed to correctly identify the curvature induced secondary motions. These motions appear to be governed by a small number of highly energetic modes, active at different times. These modes may be used to reconstruct the flow, filtering the smaller structures, showing a "swirl switching" behavior, first noted by Tunstall & Harvey (1968).

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Leo Hellström
Princeton University

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