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Fourier decomposition of periodic flow using DPIV[1] IVAN KORKISCHKO, IAGO C. BARBEIRO, JULIO R. MENEGHINI, J.A.P. ARANHA, University of Sao Paulo — Digital particle image velocimetry (DPIV) is employed to measure the velocity fields of the flow past a circular cylinder in the $50<Re<340$ range and a Fourier series based on the Strouhal period is employed to decompose the periodic time series up to the third harmonic. The series converges with decreasing coefficients and the final residual related to the DPIV initial data is very low. The first harmonic illustrates the von Kármán vortex street and its characteristic antisymmetric pattern with respect to the streamwise centerline. The second one is symmetric being responsible for the drag force main oscillations while the third is again antisymmetric. The harmonics respect the hierarchy suggested by the asymptotic series solution of the Hopf bifurcation and comparisons between the experimental results and FEM numerical simulations show good agreement in the considered Re range. Besides the validation of numerical simulations, the proposed decomposition can be used to reconstruct the periodic flow in order to minimize the effects of gappy data and measurement uncertainties. And for this case it is also very effective to decompose the flow in its most coherent structures.

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