Cross-correlation in a turbulent flow: Analysis of the velocity field by $\rho_{DCCA}$ coefficient

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$\rho_{DCCA}$ coefficient [1] is designed to perform the analysis of cross-correlations in non-stationary time series. It has been used in many processes that occur in nature, as well as in problems related to physics, health, politics and econometrics. In these cases data have been collected in real world, but an equation of motion for the variables involved obeying natural laws do not exist, except for simplified modeling. Here in this work the deterministic equation of Navier-Stokes is explored. Because random perturbations are applied in this non-linear equation, the solutions fit into the category of stochastic processes due to natural circumstances. Thus, we will explore the cross-correlations of the velocity field time series of a turbulent flow calculated by the Navier-Stokes equation, at different points in a simulated two-dimensional pipe with and without obstacles [2].

The results obtained for the detrended cross-correlation coefficient allowed interpretations consistent with a validation model, in which a turbulence generator is incorporated to the structure, also in which the symmetry of the generator is broken. From the detrended cross-correlation coefficient was possible to qualify how adherent are each velocity field with respect to the channel position.