## NUMERICAL INVESTIGATION OF THE TRANSIENT AND TURBULENT FLOW AROUND A CYLINDER OF SQUARE SECTION

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The purpose of the present work is the numerical investigation of the unsteadiness of the flow around a cylinder of square cross-section. The objective is to study the laminar and transient regimes.

The range of the study is covered by Reynolds numbers between Re=30-2000. The first flow instability, the vortex shedding, has been detected between Re=40-45.

The 2D-3D transition which is the second flow instability has been found between Re=150-200. Then, the flow has been studied in depth in the range Re=150-500 where numerical values are available for the comparison. The effects of numerical parameters like the number of points in the periodic direction and the accuracy of the numerical scheme have also been investigated. The study of the 3D character of the flow has been made using correlation coefficients and vorticity isolines.

Then the range Re=500-2000 has been studied for trying to detect the first presence of turbulence in the flow. The comparison of the Reynolds shear stress profiles at Re=2000 with the corresponding ones at Re=22,400 revealed that the flow became turbulent in the range Re=1000-2000.

The results have been validated comparing the Strouhal numbers at different Reynolds numbers with both reference numerical and experimental data (log-linear figure 1). The Strouhal numbers have been extracted from the lift coefficient signals in time. An example of lift signal is given in the figure 2 for Re=200.



Figure 1: Summary of the results

Figure 2: Lift coefficient signal for Re=200