Numerical Simulation of 2D Flow through a Packed Bed of Square Cylinders

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Abstract. This paper is centred on a compact finite differences method for the calculation of two-dimensional viscous flows through complex geometries. The immersed boundaries are set through body forces that allow for the imposition of boundary conditions that coincide with the computational grid. Two different flow configurations are simulated. First, the flow past a cylinder with square cross-section inside a plane channel is calculated. The computed average drag coefficient and Strouhal number are compared to data available in the literature. The agreement between the results is good. The second flow configuration analyzed is the flow through a porous matrix composed of equal size staggered square cylinders. Flow visualization results are shown. The work presented in this paper illustrates the potential of the immersed boundary method in general and of this implementation in particular to simulate the flow through porous matrices.