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An immersed boundary method using the discrete streamfunction approach with an implicit forcing[1] XING ZHANG, LNM, Institute of Mechanics, Chinese Academy of Sciences — Recently, Colonius and Taira (Comput. Methods Appl. Mech. Engrg. 2008) present an immersed boundary method in which the discrete streamfunction approach is used to solve the incompressible Navier-Stokes equations. In this talk, we proposed a novel immersed boundary method in the framework of the discrete streamfunction approach. Similar to the method of Colonius and Taira, the forcing term to impose the non-slip boundary condition is determined implicitly (by solving a linear system). However, in the present method, the linear system is in a simpler form and much easier to solve. The time to compute the forcing term is found to be negligible comparing with that to solve the Navier-Stokes equations. Some verifications and validations of this new method are presented. An accuracy test is first performed by using the decaying-vortex problem, both with and without the presence of immersed boundaries. Some canonical cases are then simulated, such as the flow over stationary and oscillating cylinders and flow over a vertical plate of zero thickness. All numerical results are in good agreement with those in literature. This is an indication that the method can handle boundaries of different shapes with acceptable accuracy.

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