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The effective slip length and vortex formation in laminar flow over a rough surface ANOOSHEH NIAVARANI, NIKOLAI PRIEZJEV, Michigan State University — The flow of viscous incompressible fluid over a periodically corrugated surface is considered by the numerical solution of the Navier-Stokes equation. We define the effective slip length with respect to the level of the mean height of the surface roughness. With increasing corrugation amplitude the effective no-slip boundary plane is shifted towards the bulk of the fluid what implies a negative effective slip length. Analysis of the flow streamlines shows that a flow circulation is developed in the grooves of the rough surface provided that the local boundary condition is no-slip. By applying a local slip boundary condition, the location of vortex is displaced towards the bottom the grooves and the effective slip length increases. For values of the local slip length larger than the period of the surface corrugation, the vortical structure disappears, the flow streamlines are deformed to follow the surface curvature, and the effective slip length saturates to a constant value. Inertial effects promote vortex flow formation in the grooves and reduce the effective slip length.

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