

Dependence Of Friction On Boundary Curvature For Navier-slip Conditions And Highly Viscous Liquids

A. Riefer¹, P. Damm¹, G. Meichsner¹, M. Hackert-Oschätzchen¹

¹Chair of Manufacturing Technology with Focus Machining, Otto von Guericke University Magdeburg, Universitätsplatz 2, 39106 Magdeburg, Germany

Abstract

The motion of a fluid can be described by the incompressible Navier-Stokes equations (NSE). A single particle embedded in the fluid experience a resistance resulting from a friction force. The friction force depends typically on the velocity but is directed in the opposite direction to the movement. In the present study, the friction force at the boundary (modelled by the Navier-slip condition) is investigated with analytical and numerical methods. Applying analytical mechanics, relations between the tangential velocity and the acceleration could be found. Applying COMSOL Multiphysics®, the analytical results were checked with numerical simulations within the finite element method. It was found, that while the analytical relation between the velocity and the normal acceleration (at the boundary) can be confirmed numerically, the tangential acceleration is larger than the analytically computed value.