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Flows in micro-channels with side-wall mass injection[1] MARK SHORT, Los Alamos National Laboratory, DAVID KESSLER, University of Illinois — Incompressible, inviscid, rotational flows in rectangular and cylindrical large aspect ratio channels with side-wall mass injection form the basis for the study of the core flow in solid rocket motors (the Taylor-Proudman-Culick solutions). The assumption of incompressible inviscid flow is based on the relative magnitudes of the side-wall injection Mach number and the channel aspect ratio. Extensions to compressible inviscid flows have been considered by Balakrishnan, Linan, and Williams. Here we consider an analysis of steady flow in long, but very narrow, rectangular and cylindrical channels with side-wall mass injection where viscous effects must be accounted for, since the usual surface boundary layer flow cannot be blown off the injection surface due to the small injection surface separation. We develop asymptotic and numerical solutions for the viscous compressible rotational flow in the channel. The work has application to recent interest in the development of micro-propulsion systems.

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