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NUMERICAL STUDY OF NORMAL PRESSURE DISTRIBUTION IN ENTRANCE PIPE FLOW*

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Abstract. This paper deals with the computation of pipe flow in the entrance region. The pressure distribution and flow characteristics, particularly the effect of vorticity in the vicinity of the wall, are analyzed for Reynolds numbers (Re) ranging from 500 to 10000. The pressure gradient in the normal or radial direction is caused by the normal component of the curl of vorticity, which decreases as Re increases. It is found, for the first time, that the pressure gradient along the normal direction near the pipe inlet is negative, i.e., the pressure at the wall is lower than that at the central core for Re $\leq$ 5000. This result is beyond the scope of the boundary-layer assumption and contrary to the consequence of Bernoulli's law.

Key words. computational fluid dynamics, numerical analysis

AMS subject classifications. 15A15, 15A09, 15A23

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