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NUMERICAL STUDY OF NORMAL PRESSURE DISTRIBUTION IN ENTRANCE FLOW BETWEEN PARALLEL PLATES, I. FINITE DIFFERENCE CALCULATIONS*

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Abstract. This paper deals with the computation of flow between two parallel plates, including the pressure distribution in the entrance region. There are few implicit solutions available for the pressure distribution in the normal or y-direction of such flows. The pressure distribution in the y-direction is thus computed for the first time for flow between parallel plates. The minimum critical Reynolds number for laminar-turbulent transition is known to be in the range from 1300 to 1400, and we have thus focused our finite difference computations of the pressure gradient in the y-direction at Reynolds numbers (Re) between 100 and 5000. Our results have enabled us to conclude that a large difference in pressure between the wall and the centerline exists near the inlet for a low Re and decreased as Re increased. The pressure at the wall is lower than that in the central core for $Re \leq 5000$, indicating that the pressure distribution is contrary to Bernoulli's law across parallel plates, although the law does not apply to viscous flow.

Key words. computational fluid dynamics, numerical analysis.

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