

CALCULATION OF MINIMUM CRITICAL REYNOLDS NUMBER FOR LAMINAR-TURBULENT TRANSITION IN PIPE FLOWS*

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Abstract. This article describes the calculation of the minimum critical Reynolds number for laminar-turbulent transition in pipe flows. From the conclusions of our previous experimental study, it is clear that a transition occurs near the pipe inlet and the critical Reynolds number R_c takes the minimum value of about 2000 in the case of a straight pipe. Moreover, in our previous calculations of laminar entrance pipe flow, it was found that near the pipe inlet a large pressure gradient in the radial direction exists, which decreases as the Reynolds number Re increases. Thus, we have built a new transition macromodel to determine R_c using the effect of the radial pressure gradient. The calculated results were $R_c(min) = 3750$ when the number of radial grid points $J_0 = 51$ and 2200 when $J_0 = 101$.

Key words. hydrodynamic stability, grid refinement, thermodynamics

AMS subject classifications. 76E05, 65M50, 80A05

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