

Abstract Submitted
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Extrapolating Channel Flow Data to High Reynolds Number Conditions¹ RICARDO VINUESA, KRIS DRESSLER, HASSAN NAGIB, IIT — Channel and pipe flows require relatively larger Reynolds numbers (Re) than boundary layers to achieve “high- Re conditions” for wall-bounded flows. Unlike the pipe case, where the Superpipe results far exceed such conditions, even the highest Re channel experiments have not reached such a state. Because of the extremely large channel facility required to achieve these high- Re conditions with good spatial resolution for the measurements, DNS may present the best hope. Available experimental and DNS results, and new data from a channel with variable aspect ratio, are used to estimate the high- Re von Kármán coefficient and the Re required to achieve it. Wall shear stress measurements with oil film interferometry were obtained over the range $7,500 < Re_m < 30,000$ in channel flows for aspect ratios varying from 18 to 48. The results show that the relationship between Reynolds number and skin-friction coefficient depends on the channel aspect ratio well beyond the traditional values of 8 to 12 generally believed to ensure two-dimensionality. The results indicate that an increase by a factor of about four or five in the current Re capabilities of DNS is required to approach the asymptotic von Kármán coefficient for the channel, which likely is even lower than our recent estimates of 0.37.

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