stable" steady state of $C_{AS} = 0.270$ produces a yield of 46%. To run a reactor, with full assurance of stability, at a substantially higher yield by simply inserting a cooling coil and making the flow rate of cold water through this coil proportional to the temperature deviation from the desired steady-state temperature (as suggested by Aris and Amundson) certainly is a practical way of operating the system. Much of the uncertainty of choosing the initial starting conditions can thereby be avoided altogether.

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Streaming Potential Fluctuation around a Cylinder in Water

SIR: We wish to point out some of our recent results regarding the effect of free stream turbulence on the flow past circular cylinders held transversely to the main stream in the Reynolds number range 4000 to 10,000. The free stream turbulence intensity ranged from 0.5% (clear tunnel) to 12.5%. Contrary to the findings of Liu, Binder, and Cermak (1970), we did not find any noticeable effect of free stream turbulence on the Strouhal number over the entire range of Reynolds numbers and intensities. The experiments were conducted in the 11 × 11 inch test section of a low-speed wind tunnel. Smooth Plexiglas cylinders ranging in diameter from $^1/_4$ to 1 inch were used. The shedding frequency was measured by placing a hot-wire probe in the near wake (about 2 diameters downstream and 0.5 diameter off the axis) and autocorrelating the turbulence signal in real time. The accuracy of the frequency measurement is estimated to be within 2%. Bearman (1968) has also reported absence of any effect of free stream turbulence on the Strouhal number in the subcritical Reynolds number range. The critical Reynolds number itself, however, is a function of the stream turbulence.

The streaming-potential-fluctuation (SPF) spectra of Liu, Binder, and Cermak do not display the Strouhal peak at the forward stagnation point ($\theta = 0°$) in the presence of an estimated free stream turbulence level of approximately 2.75%, while our hot-wire autocorrelation measurements in the vicinity of the forward stagnation point ($^1/_{10}$ diameter upstream) did exhibit the Strouhal frequency up to free stream levels of about 5.0%. At higher free stream levels, the wake-induced periodicity cannot be detected around $\theta = 0°$. Smith (1968) has also reported some spectral data indicating the effect of free stream turbulence on the periodicity of the flow near the forward stagnation region.

In view of the above discussion, it is suggested that the lowering of the Strouhal frequency when the test cylinder is located in a fully developed turbulent pipe flow is possibly owing to extraneous sources other than the turbulence level. For instance, the effective band width of the filters, sweep rate, and the integrating time constant of the electronic circuitry could affect the location of the spectral peaks within a few per cent. Precise location of the frequency becomes especially difficult when the peak becomes broader as a result of the stream turbulence. (Compare Figure 7 with Figures 8 to 11 of Liu *et al.*, 1970.) Manual tuning of the spectral analyzer using narrow-band filters or use of a time-delay correlator would yield more accurate results.

In connection with their observation that the average mean velocity should be used in the Strouhal number computation when the main stream velocity varies along the axis of the cylinder, the authors may wish to refer to the recent paper of Chen and Mengione (1969).

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SIR: If the discrepancies pointed out by Mujumdar and Douglas were indeed caused by a deficiency in the electronic circuitry used in recording and/or analyzing the streaming potential fluctuations, as they suggested, it would be difficult to understand why a correct location of Strouhal peaks was possible with the same equipment when the test cylinder was located near the pipe entrance (see Figures 6 and 7), but not when it was situated in a fully developed region (Figures 8 to 11). It would be even more difficult to explain why the four runs in fully developed flows all experienced lowered Strouhal frequencies. The Strouhal frequencies in these cases were found to be approximately 20 to 30% lower than usual; such differences exceed expected errors arising from a manual determination of the peak of a spectral graph.

For these reasons we do not feel that the peculiarity displayed by our signal had anything to do with the electronic