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Development of the Turbulent Flow in a Bent Pipe PHILLIP WILSON, University of Canterbury, FRANK SMITH, University College London — The three-dimensional incompressible turbulent flow through a slender bent pipe of simple cross-section is analyzed, the pipe gradually bending the rapid flow through a substantial angle. The ratio of the relative radius of curvature to the magnitude of the turbulent fluctuations is a crucial factor: analysis of the entry region involving exact solutions of the governing equations shows three different downstream developments, depending on the magnitude of that ratio. The main velocity components are found in each case, and one downstream development studied in detail is when turbulence dominates the flow. The present physical situation arises commonly in industrial settings but has been little studied previously. The working applies for any two-tier mixing-length model, and, as a most surprising feature, the fully developed flow far downstream is not unique, being found to depend instead on the global flow behaviour (thus the centre-line velocity is not determined simply by the pressure drop, in contrast to the laminar case).

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