5-10. Generalize Prob. 5-9 to calculate and plot the instability point $(x/L)_{\text{crit}}$ as a function of U_0L/ν.

5-11. For potential freestream flow across a circular cylinder, $U = 2U_0 \sin(x/a)$, if $Re_D = 10^6$, estimate the position $(x/a)_{\text{crit}}$ where boundary-layer instability first occurs.

5-12. Extend the discussion of boundary-layer-profile wall curvature, Eq. (5-30), to a permeable wall. Predict whether wall blowing or suction will stabilize or destabilize a flow.

5-13. Assume a boundary-layer velocity profile approximating a Pohlhausen polynomial from Eq. (4-131) with any nonzero value of Λ (have each member of the class select a different Λ). Estimate the critical (instability) value of Re_{δ^*} for this profile.

5-14. For stagnation boundary-layer flow, $U = Kx$, estimate the position Re_x where transition first occurs, using the method of Michel, Eq. (5-38). What makes the correlation of Granville (Sec. 5-5.1.1) inappropriate? Assume negligible freestream turbulence.

5-15. For the separating Falkner-Skan wedge-flow boundary layer, $\beta = -0.19884$, use any appropriate correlation to estimate the position Re_x where transition first occurs. Neglect freestream turbulence. Compare your result with Fig. 5-32.

5-16. For the Howarth freestream velocity $U = U_0(1 - x/L)$, if $U_0L/\nu = 2 \times 10^6$, use the correlation of Michel, Eq. (5-38), to estimate the point (x/L) where boundary-layer transition occurs. Neglect freestream turbulence. Compare your result with Fig. 5-31.

5-17. Generalize Prob. 5-16 into a parametric computer study to compute and plot $(x/L)_{\text{tr}}$ vs. U_0L/ν.

5-18. For potential freestream flow across a circular cylinder, $U = 2U_0 \sin(x/a)$, if $Re_D = 2 \times 10^6$, use the correlation of Michel, Eq. (5-38), to estimate the position $(x/a)_{\text{tr}}$ where boundary-layer transition first occurs. Neglect freestream turbulence. Compare your result with Fig. 5-31.

5-19. Generalize Prob. 5-18 into a parametric computer study to compute and plot $(x/a)_{\text{tr}}$ vs. U_0D/ν.

5-20. Modify Prob. 5-14 for a freestream turbulence level of 1 percent.

5-21. Modify Prob. 5-15 for a freestream turbulence level of 1 percent.

5-22. Modify Prob. 5-16 for a freestream turbulence level of 1 percent.

5-23. Modify Prob. 5-18 for a freestream turbulence level of 1 percent.

5-24. Generalize Prob. 5-22 into a parametric computer study to compute and plot $(x/L)_{\text{tr}}$ vs. U_0L/ν for various freestream turbulence levels.

5-25. Air at 20°C and 1 atm flows at $U = 12$ m/s past a smooth flat plate. It is desired to trip the boundary layer to turbulence by stretching a 1-mm-diameter wire across the plate at the wall. Where will transition occur if the wire is placed at $x = 1$ m? What wire location x will cause earliest transition?

5-26. Repeat Prob. 5-25 if the freestream turbulence level is 1 percent.

5-27. The narrow vertical white band, in the chaotic area of the logistic map in Fig. 5-38, lies in the region $3.825 < r < 3.865$. Beginning at $r = 3.825$ with an initial guess $x = 0.5$, make repeated computer iterations, for small increments $\Delta r \leq 0.0005$, of the logistic relation (5-52) and plot the results on an expanded abscissa for this region. Comment on the remarkable pattern you find.