Problems for Momentum Transfer


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<td>Chapter 2: Shell momentum balance, creeping flow around a sphere</td>
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<td>Chapter 3: Equation of continuity, the equation of motion, substantial derivatives.</td>
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2. Discuss the following
   a) Laminar and turbulent flow
   b) No slip boundary conditions
   c) Reasons of turbulence
   d) Boundary layer and potential flow
   e) Momentum flux and shear force
   f) Substantial derivative

3. Write the shell momentum balance for flow between two parallel plates, top of which is moving at constant velocity $V$ while the bottom plate is stationary.
4. Solve the following problems from the book “Transport Phenomena” by Bird, Stewart and Lightfoot, by using shell momentum balance
   - 2A.1, 2B.1, 2D.2, 2E.2, 2G.2, 2J.2, 2F.2, 2L.3, 2N.4 (1st Edition) / 2A.1, 2A.3, 2B.1, 2B.2, 2B.3, 2B.5, 2B.6, 2B.7, 2B.8, 2B.9 (2nd Edition)

5. Three parallel plates are separated by two fluids. The bottom plate, plate 1, is at rest. Water of viscosity 0.8 Cp at 30°C lies between plate 1 and 2, while toluene, viscosity 0.52 Cp lies between plate 2 and 3. The distance between each pair of plates is 10 cm. Plate 3 moves at 3 m/sec. Find the velocity of plate 2 at steady state. Also, determine the force per unit area on plate 3 required to maintain the velocity at 3 m/sec.

6. Solve the following problems from the book “Transport Phenomena” by Bird, Stewart and Lightfoot, by using the Navier Stokes Equation
   - 3A.2, 3B.2, 3D.2, 3E.2, 3F.2, 3J.2, 3K.2, 3Q.3 (1st Edition) / 3A.1, 3A.4, 2B.11, 3B.4, 3B.10 (2nd Edition)

7. Solve the following problems for non-Newtonian fluids from the book “Transport Phenomena” by Bird, Stewart and Lightfoot, by using the equation of motion
   - 2H, 2I, 2K, 3R (1st Edition) / 8B.3, 8B.5, 8A.1, 8B.2 (2nd Edition)