Homework 6

(due at 11:59 am on December 3, 2010)

Chapter 5: Problems 5.91, 5.98, 5.125

Chapter 6: Problems 6.9, 6.16, 6.18, 6.34

Problem 8. Consider a rocket moving straight up in the gravity field, as in figure 2. Let the initial mass be M_0, and assume a steady exhaust mass flow $\dot{m}$ and exhaust velocity V_e relative to the rocket, as shown. If the flow pattern within the rocket motor is steady and air drag is neglected, derive the differential equation of vertical rocket motion $V(t)$ and integrate it using the initial condition $V = 0$ at $t = 0$.

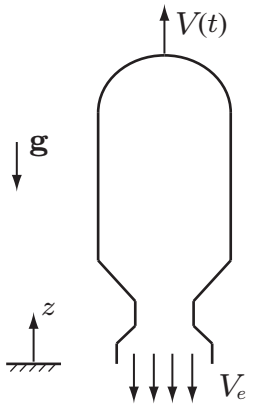

Figure 1: Rocket moving straight up.

Problem 9. A rectangular block of mass M, with vertical faces, rolls without resistance along a smooth horizontal plane as shown. The block travels initially at speed U_o. At $t = 0$ the block is struck by a liquid jet and its speed begins to slow. Obtain an algebraic expression for the acceleration of the block for $t > 0$. Solve the equation to determine the time at which $U = 0$.

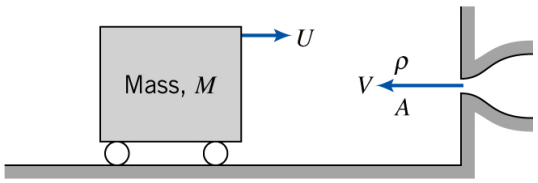

Figure 2: Rectangular block moving toward nozzle.