1.2 Example Case

An example of this type of model is the Optimal Rocket Time Problem. The problem is to minimize the travel time t of a rocket in such a way that the rocket have velocity zero at the final destination. I enforce constraints on the positive and negative acceleration of the rocket together with a maximum velocity. I also consider fuel use. The parameters have no parallel to a real case and is chosen for there convenience.

Position is given as s, velocity as v, force as u, and mass as m. The model looks as follows

$$\min_{t_f} \quad t_f \tag{1.6a}$$

$$\text{s.t.} \quad \dot{s}(t) = v(t) \tag{1.6b}$$
$$\dot{v}(t) = \frac{u(t) - 0.2 * v(t)^2}{m(t)} \tag{1.6c}$$
$$\dot{m}(t) = -0.01 * u(t)^2 \tag{1.6d}$$

$$s(t_0) = 0.0 \tag{1.6e}$$
$$v(t_0) = 0.0 \tag{1.6f}$$
$$m(t_0) = 1.0 \tag{1.6g}$$

$$v(t) \leq 1.7 \tag{1.6h}$$
$$v(t) \geq 0.0 \tag{1.6i}$$
$$u(t) \leq 1.1 \tag{1.6j}$$
$$u(t) \geq -1.1 \tag{1.6k}$$

$$s(t_f) = 10.0 \tag{1.6l}$$
$$v(t_f) = 0.0 \tag{1.6m}$$

This model have the following solution

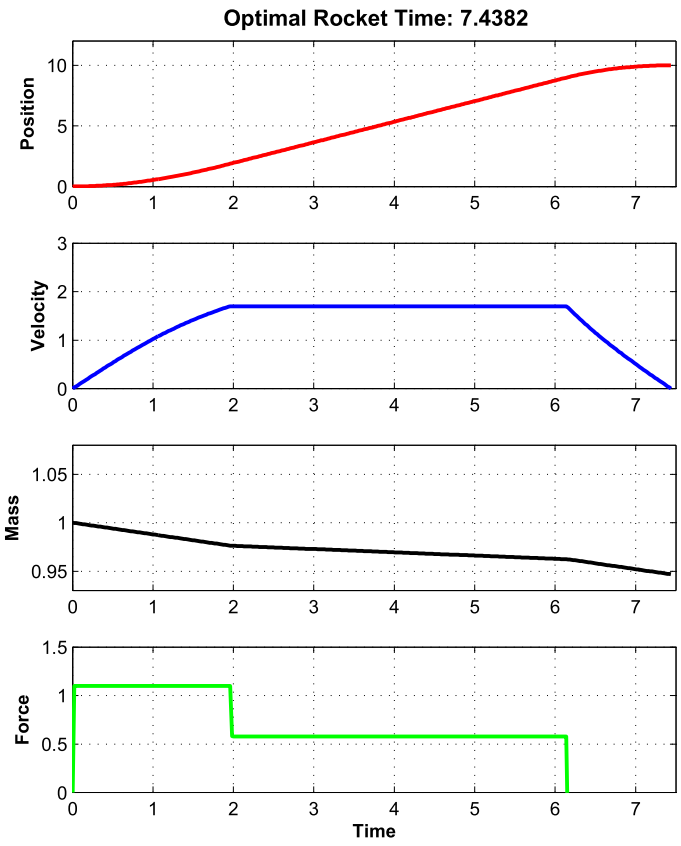

Figure 1.1: Position, Velocity, Mass, and Force of the Optimal Rocket Time Problem