8.8
A thick polystyrene wainscoating (panel below chair rail) covers the wall of a room up to 1m from the floor. It is ignited over a 0.2 m region and begins to spread. Assume that the resulting smoke layer in the room does not descend below 1m and no mixing occurs between the smoke layer and the lower limit. The initial temperature is 20 C, the ambient oxygen mass fraction is 0.233 and the specific heat of air is 1 J/(gK).

$rho := 40 \quad cp := 1500 \quad ks := .4 \quad Tig := 400 + 273 \quad Dhc := 39 \cdot 10^6 \quad rst := 3 \quad Lfg := 1.8 \cdot 10^6$

$Yox := 0.233 \quad Te := 20 + 273 \quad xp := 0.2 \quad cpa := 1000$

Calculate the upward spread rate at 0.5 m from the floor. The flame height is 1.8 m and the heat flux from the flame is estimated to be 3 W/cm^2 (30,000 W/m^2).

Use thick flame spread equation

$qf := 30000 \qquad xf := 1.8$

$$vp := \frac{4 \cdot qf^2 \cdot (xf - xp)}{\pi \cdot ks \cdot cp \cdot rho \cdot (Tig - Te)^2} \qquad vp = 0.529 \ \frac{m}{s}$$

if use a steady theory....otherwise, there is enough data to use the transient result.