Notes in APPM 4650
Adam Norris

Zachary Vogel

November 6, 2015

1 Project con.

env at $t + 0$. $f + 0x$

$$a + t = 0$$
$$T = T_0$$

$A_f \sim$ cone of fuel

$$\frac{dA_f}{dt} = -c_0 A_f e^{-\frac{E}{RT}}$$

$\dot{Q}_{\text{loss}} = H(T - T_0)$
Conservation of energy(thermal)

$$\frac{dE}{dt} = -c_0 \frac{dA_f}{dt}_{\text{source}} - \dot{0}_{\text{loss to sunraml}}$$
$$SC_v \frac{dT}{dt} = c_0 e^{-\frac{E}{RT}} - H(T - T_0)$$

ρ is mass density, C_v is heat capacity
$T|_{t=0} = T_0$

$$\tilde{T} = \frac{T}{T_0} = 1 + (\epsilon\theta)$$

want to study theta.

$$\mathfrak{T} = \frac{t}{t_{\text{char}}}$$

High activation energy problem

$$\epsilon = \frac{RT_0}{E} << 1$$
$$T = T_0 + \epsilon\theta T_0$$

$$t = Tt_{\text{char}}$$

$$\frac{d\theta}{d\mathfrak{T}} = e^{\theta} - \frac{\theta}{\delta} \quad \theta|_{\mathfrak{T}=0}0$$

$\delta \sim \frac{1}{H} \sim$ named Frank Kammetski parameter, has a bunch of other constant burried in it.
scaled time a bunch, that's why $\mathfrak{T}$ and T.
define $\sigma = \delta T$.

$$\frac{d\theta}{d\sigma} = \delta e^{\theta} - Q \quad \theta|_{\sigma=0} = 0$$

rate of heat generation is the delta exponential term, rait of heat loss to environment is the Q.
differential term is the rate of energy accumulation in the box.
A graph of theta vs sigma is close to 0 for a while, then can explode. This can be delayed if you remove enough energy. It can also just fizzle if your removing energy fast enough.
Equilibrium vs fig

$$\delta e^{\theta} - \theta = 0$$

that is the dividing line between fizzle and explotion.

$$\delta e^{\theta} - \theta = 0$$

$$\delta e^{\theta} - 1 = 0$$

$$\theta = 1$$

$$\delta = \frac{1}{e}$$

gonna need to take some special steps to make the ode solver work.
when you have weird explosions and stuff, you call it a stiff differential equation.