

MECH4450 Aerospace Propulsion

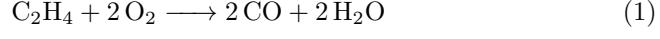
# Major Assignment - Part 1

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The following finite rate chemistry mechanisms provide an accurate model of fuel combustion within a scramjet engine.



The rates of formations for the individual species are given as:

$$\frac{d[\text{C}_2\text{H}_4]}{dt} = -k_1[\text{C}_2\text{H}_4]^{0.5}[\text{O}_2]^{0.65} \quad (3a)$$

$$\frac{d[\text{O}_2]}{dt} = -2k_1[\text{C}_2\text{H}_4]^{0.5}[\text{O}_2]^{0.65} - \frac{1}{2}k_{2f}[\text{CO}][\text{O}_2]^{0.5} + \frac{1}{2}k_{2r}[\text{CO}_2] \quad (3b)$$

$$\frac{d[\text{CO}]}{dt} = 2k_1[\text{C}_2\text{H}_4]^{0.5}[\text{O}_2]^{0.65} - k_{2f}[\text{CO}][\text{O}_2]^{0.5} + k_{2r}[\text{CO}_2] \quad (3c)$$

$$\frac{d[\text{H}_2\text{O}]}{dt} = 2k_1[\text{C}_2\text{H}_4]^{0.5}[\text{O}_2]^{0.65} \quad (3d)$$

$$\frac{d[\text{CO}_2]}{dt} = k_{2f}[\text{CO}][\text{O}_2]^{0.5} - k_{2r}[\text{CO}_2] \quad (3e)$$

where  $k_1$  is the rate of reaction for Eq. 1, and  $k_{2f}$  and  $k_{2r}$  are the forward and backward reaction rates for Eq. 2 respectively.