HW #8a

Power System Theory & Design
Theoretical Otto Cycle
Part I → Reversible Adiabatic Compression

Given: $Y/Y_{ec} = 0.70, 1.0, 1.40$ (3 cases)

Same as class example:
- Fuel: Octane
- Compression Ratio, $r_v = 9.0$
- $T_1 = 300\,K$, $P_1 = 100\,kPa$, $V_1 = 0.5$ Liters

Determine: T_2 (degrees K)
P_2 (kPa)
$_1W_2 = W_{compression}$ (KJ/compression stroke)

Determine for all three cases, Y/Y_{ec}, given above.
(Note: $Y/Y_{ec} = 1.0$ is exactly the class example)

Power Systems Theory & Design HW # 8b

Theoretical Otto Cycle

Part II → Constant Volume, Ideal Complete Adiabatic Combustion.

Given: $Y/Y_{cc} = 0.70, 1.0, 1.40$ (3 cases)

Fuel: Octane

Use T_2, P_2 and mole numbers & mole fractions of reactants from part I.

Determine: T_3 (degrees K)

P_3 (Kpa)

mole fractions products (y_{CO} y_{CO_2} y_{H_2O}, y_{O_2}, y_{N_2})

mole numbers of products (n_{CO} n_{CO_2} n_{H_2O}, n_{O_2}, n_{N_2}, n_{tot} (products))

Determine for all three cases, Y/Y_{cc}, given above.

(Note: $Y/Y_{cc} = 1.0$ is exactly the class example, where $T_2 = 623.367K$, $P_2 = 1870.10$ kPa, etc.)

Power Systems Theory & Design HW # 8c

Part III Reversible Adiabatic Expansion

Given: Y/Y_{cc} = 0.70, 1.0, 1.40 (3 cases)

Use T_3, P_3, and mole fractions and mole numbers of the products of combustion from Part II.

Determine: T_4 (degrees K)

P_4 (kPa)

$_3W_4 = W_{Expansion}$ (KJ / expansion stroke)

Determine for all three cases, Y/Y_{cc}, given above.
(Note: $Y/Y_{cc} = 1.0$ is exactly the class example, where $T_3 = 3142.23$ K, $P_3 = 9972.04$ kpa, $y_{co} = 0$, $y_{co_2} = 0.125$, $y_{H_2O} = 0.140625$, $y_{O_2} = 0$, $y_{N_2} = 0.734375$, $n_{co} = 0$, $n_{co_2} = 2.65062E{-}06$ Kmoles, $n_{H_2O} = 2.98194E{-}06$ kmoles, $n_{O_2} = 0$, $n_{N_2} = 1.55724E{-}05$ Kmoles, $n_{tot\,(products)} = 2.12049E{-}05$ Kmoles.)