IC Engine

Formual Sheet – Final Term – Spring 2021

$c_i = \sqrt{kRT}$

$\eta_v = m_a/\rho_a V_d$

$\eta_v = n\dot{m}_a/\rho_a V_d N$

$\text{bsfc} = \dot{m}_f/\dot{W}_b$.

$Q_{in} = m_f Q_{HV}\eta_c$

$l_{max} < d_v/4$

$U_p/\overline{U}_p = (\pi/2)\sin\theta[1 + (\cos\theta/\sqrt{R^2 - \sin^2\theta})]$

$R = r/a$

$V_d = N_c(\pi/4)B^2 S$

$s = a\cos\theta + \sqrt{r^2 - a^2\sin^2\theta}$

$\overline{U}_p = 2SN$

$\dot{m}_f = C_D A_n\sqrt{2\rho_f \Delta P}$

$r_c = V_{BDC}/V_{TDC} = (V_c + V_d)/V_c = v_{BDC}/v_{TDC}$

$A_p = (\pi/4)B^2$

$I = mB^2/8$

$mep = \dfrac{W}{V}$

$R = \text{gas constant for air} = 0.287 \text{ kJ/kg-K} = 53.33 \text{ ft-lbf/lbm-°R}$

$\dot{W} = WN/n$

$\dot{W} = 2\pi N\tau$

$\dot{W} = (1/2n)(mep)A_p\overline{U}_p$

$\dot{C}_{Dv} = \overline{A_{act}/A_{pass}}$

$SP = \dot{W}_b/A_p$

$OPD = \dot{W}_b/V_d$

$SV = V_d/\dot{W}_b$

$SW = (\text{engine weight})/\dot{W}_b$

$m_f = C_D A_n\sqrt{2\rho_f \Delta P}\,(\Delta\theta/360N)$

$A_{pass} = \pi d_v l$

$\Gamma = I\omega$

$(SR)_1 = (\text{angular speed})/(\text{engine speed}) = \omega/N$
$(SR)_2 = (\text{swirl tangential speed})/(\text{average piston speed})$
$= u_t/\overline{U}_p$

$Q = mCdT$

$\dot{W}_{sc} = \dot{m}_a(h_{out} - h_{in}) = \dot{m}_a c_p(T_{out} - T_{in})$

$T_{2s} = T_1(P_2/P_1)^{(k-1)/k}$

$(\eta_s)_{sc} = \dot{W}_{isen}/\dot{W}_{act} = [\dot{m}_a(h_{2s} - h_1)]/[\dot{m}_a(h_{2A} - h_1)]$
$\phantom{(\eta_s)_{sc}} = [\dot{m}_a c_p(T_{2s} - T_1)]/[\dot{m}_a c_p(T_{2A} - T_1)] = (T_{2s} - T_1)/(T_{2A} - T_1)$

$\eta_m = (\dot{W}_{act})_{sc}/\dot{W}_{from\ engine}$

$Eff = (T_1 - T_2)/(T_1 - T_{coolant})$

$(\eta_s)_{turb} = (\dot{W}_t)_{act}/(\dot{W}_t)_{isen}$
$\phantom{(\eta_s)_{turb}} = [\dot{m}_a(h_1 - h_{2A})]/[\dot{m}_a(h_1 - h_{2S})] = (T_1 - T_{2A})/(T_1 - T_{2S})$

$\eta_{turbo} = (\eta_s)_{comp}\,(\eta_s)_{turb}\eta_m$