# FORMULÁRIO

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| $\dot{E}_e - \dot{E}_s + \dot{E}_g = \dot{E}_{ac}$ | $\vec{q}'' = -k\frac{dT}{d\vec{n}}$ | $q''_{conv} = h\left(T_s - T_\infty\right)$ |
| $q''_{rad} = \epsilon\sigma\left(T_s^4 - T_{viz}^4\right)$ | $R_{t,conv} = \frac{1}{hA}$ | $R_{t,rad} = \frac{1}{h_r A}$ |
| $R_{t,cond} = \frac{L}{kA}$ | $R_{t,cond} = \frac{\ln(r_2/r_1)}{2\pi kL}$ | $R_{t,cond} = \frac{1}{4\pi}\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$ |
| $h_r = \epsilon\sigma A\left(T_s + T_{viz}\right)\left(T_s^2 + T_{viz}^2\right)$ | $\mathrm{Pr} = \frac{\nu}{\alpha}$ | $\mathrm{Re}_L = \frac{\rho u_\infty L}{\mu} = \frac{u_\infty L}{\nu}$ |
| $Nu_x = \frac{hL}{k}$ | $\mathrm{Pe}_x = \mathrm{Re}_x\mathrm{Pr}$ | $q_{\text{latente}} = \dot{m}h_{fg}$ |
| $\dot{m} = h_m A\left(\rho_s - \rho_\infty\right)$ | $\frac{Nu}{Pr^n} = \frac{Sh}{Sc^n}$ com $n \approx 1/3$ | $\tau_{yx} = \mu\frac{\partial u}{\partial y}$ |
| $Sc = \frac{\nu}{D_{AB}}$ | $\mathrm{Le} = \frac{\mathrm{Sc}}{\mathrm{Pr}}$ | $Sh = \frac{h_m L}{D_{AB}}$ |
| $h = \frac{-k\partial T/\partial y\vert_{y=0}}{T_s - T_\infty}$ | $C_f = \frac{\tau_s}{\rho u_\infty^2/2}$ | $St = \frac{Nu}{RePr}$ |
| $\mathrm{St}_m = \frac{\mathrm{Sh}}{\mathrm{ReSc}}$ | $q = hA\left(T_s - T_m\right)$ | $q = \dot{m}c_P\left(T_{m,s} - T_{m,e}\right)$ |
| $Gr_L = \frac{g\beta(T_s - T_\infty)L^3}{\nu^2}$ | $Ra_L = Gr_L Pr$ | $\Delta T_{ml} = \frac{\Delta T_s - \Delta T_e}{\ln(\Delta T_s/\Delta T_e)}$ |
| $q_{conv} = \overline{U}A_s\Delta T_{lm}$ | $\frac{\Delta T_s}{\Delta T_e} = \exp\left(-\frac{\overline{U}A_s}{\dot{m}c_P}\right)$ | $\beta = 1/T\ \ [K]$ |

| Correlações para ebulição | |
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| Ebulição nucleada | $q''_s = \mu_l h_{lv}\left[\frac{g\left(\rho_l - \rho_v\right)}{\sigma}\right]^{1/2}\left(\frac{c_{P,l}\Delta T_e}{C_{s,f}h_{lv}Pr_l^n}\right)^3$ |
| Fluxo máximo | $q''_{max} = 0,149h_{lv}\rho_v\left[\frac{\sigma g\left(\rho_l - \rho_v\right)}{\rho_v^2}\right]^{1/4}$ |
| Fluxo mínimo | $C\rho_v h_{fg}\left[\frac{g\sigma(\rho_l - \rho_v)}{(\rho_l + \rho_v)^2}\right]^{1/4}$ |
| Película de ebulição em piscina | $\overline{Nu}_D = C\left[\frac{g\left(\rho_l - \rho_v\right)h'_{lv}D^3}{\nu_v k_v\left(T_s - T_{sat}\right)}\right]^{1/4}$ |
| $\bar{h} = \bar{h}_{conv} + 3/4\bar{h}_{rad}$ | $\bar{h}_{rad} = \frac{\epsilon\sigma\left(T_s^4 - T_{sat}^4\right)}{T_s - T_{sat}}$ |

| Correlações para condensação | |
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| Condensação em filme | $h_D = C\left[\frac{g\rho_l\left(\rho_l - \rho_v\right)k_l^3 h'_{fg}}{\mu_l\left(T_{sat} - T_s\right)D}\right]^{1/4}$ |
| Condensação em filme N tubos | $h_D = 0,729\left[\frac{g\rho_l\left(\rho_l - \rho_v\right)k_l^3 h'_{fg}}{N\mu_l\left(T_{sat} - T_s\right)D}\right]^{1/4}$ |
| $h'_{fg} = h_{fg}\left(1 + 0,68Ja\right)$ | $Ja = \frac{c_{P,l}\left(T_{sat} - T_s\right)}{h'_{fg}}$ |
| Condensação em filme laminar sobre uma placa vertical | $\bar{N}u_L = \frac{\bar{h}_L L}{k_l} = 0,943\left[\frac{\rho_l g\left(\rho_l - \rho_v\right)h'_{fg}L^3}{\mu_l k_l\left(T_{sat} - T_s\right)}\right]^{1/4}$ |

| Correlações para convecção livre. | |
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| Laminar, $Ra_L < 10^9$ | $\overline{Nu}_L = 0,68 + \frac{0,67 Ra_L^{1/4}}{\left[1 + (0,492/Pr)^{9/16}\right]^{4/9}}$ |
| Laminar e Turbulento | $\overline{Nu}_L = \left\{0,825 + \frac{0,387 Ra_L^{1/6}}{\left[1 + (0,492/Pr)^{9/16}\right]^{8/27}}\right\}^2$ |
| Superfície Superior da Placa aquecidada ou Superfície Inferior da Placa Resfriada | $\overline{Nu}_L = 0,54 Ra_L^{1/4} \ \left(10^4 \leq Ra_L \leq 10^7\right)$ |
| Superfície Superior da Placa aquecidada ou Superfície Inferior da Placa Resfriada | $\overline{Nu}_L = 0,15 Ra_L^{1/4} \ \left(10^7 \leq Ra_L \leq 10^{11}\right)$ |
| Superfície Inferior da Placa Aquecida ou Superfície Superior da Placa resfriada | $\overline{Nu}_L = 0,27 Ra_L^{1/4} \ \left(10^5 \leq Ra_L \leq 10^{10}\right)$ |
| Cilindro Horizontal Longo; $Ra_D \leq 10^{12}$ | $\overline{Nu}_D = \left\{0,6 + \frac{0,387 Ra_D^{1/6}}{\left[1 + (0,559/Pr)^{9/16}\right]^{8/27}}\right\}^2$ |
| Esfera; $Pr \geq 0,7$; $Ra_D \leq 10^{11}$ | $\overline{Nu}_D = 2 + \frac{0,589 Ra_D^{1/4}}{\left[1 + (0,469/Pr)^{9/16}\right]^{4/9}}$ |

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| $d\omega = sen\theta d\theta d\phi$ | $d\omega = \frac{dA_1}{r^2}$ |
| $dq_{1\rightarrow 2} = I \ dA_1 \cos\theta_1 d\omega_{2\rightarrow 1}$ | $E = \int_0^\infty E_\lambda d\lambda$ |
| $E_\lambda = \int_0^{2\pi} \int_0^{\pi/2} I_{\lambda,e}\left(\lambda,\theta,\phi\right) \operatorname{sen}\theta \cos\theta d\theta d\phi$ | $G = \int_0^\infty G_\lambda d\lambda$ |
| $G_\lambda = \int_0^{2\pi} \int_0^{\pi/2} I_{\lambda,i}\left(\lambda,\theta,\phi\right) \operatorname{sen}\theta \cos\theta d\theta d\phi$ | $f_{0\rightarrow\lambda} = \frac{\int_0^\lambda E_\lambda d\lambda}{\sigma T^4}$ |
| $\epsilon_{\lambda,\theta} = \frac{I_{\lambda,e}\left(\lambda,\theta,\phi,T\right)}{I_{\lambda,b}\left(\lambda,T\right)}$ | $\epsilon_\lambda = \frac{E_\lambda\left(\lambda,T\right)}{E_{\lambda,b}\left(\lambda,T\right)}$ |
| $\alpha_{\lambda;\theta}; \rho_{\lambda,\theta}; \tau_{\lambda,\theta} = \frac{I_{\lambda,abs;ref;tr}}{I_{\lambda,i}}$ | $\epsilon = \frac{E\left(T\right)}{E_b\left(T\right)}$ |
| $\alpha_\lambda; \rho_\lambda; \tau_\lambda = \frac{G_{\lambda,abs;ref;tr}}{G_{\lambda,i}}$ | $\alpha; \rho; \tau = \frac{G_{abs;ref;tr}}{G_i}$ |
| $\alpha_\lambda + \rho_\lambda + \tau_\lambda = 1$ | $\alpha + \rho + \tau = 1$ |
| $\lambda_{max} T = C_3$ | |