$$\bar{x} = \frac{\sum F * x}{\sum F}, \quad d = x - \bar{x}, \quad \bar{d} = \frac{\sum |d\,F|}{\sum F}, \quad \sigma = \sqrt{\frac{\sum F * d^2}{\sum F}} \;; \quad h = \frac{1}{\sigma\sqrt{2}}$$

$$r_m = \frac{r_1}{\sqrt{\sum F}}, \quad \sigma_m = \frac{\sigma}{\sqrt{\sum F}}, \quad \sigma_\sigma = \frac{\sigma_m}{\sqrt{2}}, \quad r_1 = 0.6745 * \sigma$$

$L_{True} = L_{measured}\,[1 - (\alpha_{workpiece} - \alpha_{instrument})*(T - T_{standard})]$

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$$w_x = \sqrt{\left(\frac{\partial X}{\partial x_1}\right)^2 w_{x1}^2 + \left(\frac{\partial X}{\partial x_2}\right)^2 w_{x2}^2 + \ldots\ldots + \left(\frac{\partial X}{\partial x_n}\right)^2 w_{xn}^2} \;; \quad \frac{\delta X}{X} = \pm\left[\frac{x_1}{X}\frac{\delta x_1}{x_1} + \frac{x_2}{X}\frac{\delta x_2}{x_2}\right] \;; \quad \frac{\delta X}{X} = \pm\left(\frac{\delta x_1}{x_1} + \frac{\delta x_2}{x_2}\ldots\right)$$

$$\frac{dX}{X} = \pm\left(n\frac{dx_1}{x_1} + m\frac{dx_2}{x_2}\right); \quad \epsilon_{\omega_x} = \frac{\omega_x}{x}$$

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$$t_p = \frac{n\pi}{\omega_d} \;; \quad \varepsilon_s = \frac{\exp^{-\xi\omega_n t_s}}{\sqrt{1-\xi^2}} \;; \quad M_p = \exp^{\frac{-\pi\xi}{\sqrt{1-\xi^2}}} \;; \quad M_p = \frac{Y(t=t_p) - Y(t=\infty)}{Y(t=\infty)} = \exp^{\frac{-\pi\xi}{\sqrt{1-\xi^2}}}$$

$$a_o y_o = b_o y_i \;; \quad y_o = \frac{b_o}{a_o} y_i \;; \; k_s = \frac{b_o}{a_o} \;; \quad a_1\frac{dy_o}{dt} + a_o y_o = b_o y_i \;;$$

$$t_r = \frac{\pi - \phi}{\omega_d} \;, \; \tau\frac{dy_o}{dt} + y_o = k_s y_i \;; \; y_o(t) = k_s a\left(1 - e^{\left(\frac{-t}{\tau}\right)}\right) + y_{init}\, e^{\left(\frac{-t}{\tau}\right)} \;;$$

$$DE = k_s a\, e^{\left(\frac{-t}{\tau}\right)} - y_{init}\, e^{\left(\frac{-t}{\tau}\right)} \;; \; y_o(\tau) = 0.632 k_s a + 0.368 y_{init}$$

$$a_2\frac{d^2 y_o}{dt^2} + a_1\frac{dy_o}{dt} + a_o y_o = b_o y_i; \; \frac{1}{\omega_n^2}\frac{d^2 y_o}{dt^2} + \frac{2\zeta}{\omega_n}\frac{dy_o}{dt} + y_o = k_s y_i;$$

$$\omega_n = \sqrt{\frac{a_o}{a_2}} = \sqrt{\frac{K}{M}} \;; \quad \zeta = \frac{a_1}{2\sqrt{a_o a_2}} \;; \quad k_s = \frac{b_o}{a_o} = \frac{1}{K} \;; \omega_d = \omega_n\sqrt{1-\zeta^2} \;;$$

$$y_o(t) = k_s a\left[1 - \frac{e^{(-\zeta\omega_n t)}}{\sqrt{1-\zeta^2}}\, sin(\omega_d t + \emptyset)\right]; \emptyset = cos^{-1}(\zeta) \;; \; \tau = \frac{1}{\omega_n}$$

$$\frac{\rho V}{a}\frac{d^2 x}{dt^2} + \frac{B}{a}\frac{dx}{dt} + 2\rho a g x = P \;; \quad \omega_n = \sqrt{\frac{2ag}{V}} \;; \quad \zeta = \frac{B}{2\rho\sqrt{2agV}} \;;$$

$$\zeta = \sqrt{\frac{\left(ln(M_p)\right)^2}{\left(ln(M_p)\right)^2 + \pi^2}}; \qquad \frac{\rho C V_b}{H A_b}\dot{X} + X = \alpha\frac{V_b}{A_c}\theta_i$$

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$$\Delta P = \frac{256\, E\, t^3 \delta_m}{3(1-\upsilon^2)D^4} \quad ; \omega_n = \frac{20\, t}{D^2}\sqrt{\left[\frac{E}{3\,\rho\,(1-\upsilon^2)}\right]}; \quad \sigma_m = \frac{3\, D^2 \Delta P}{16\, t^2}; \quad \delta_m \le \frac{1}{2}\, t$$

$$V_o = \frac{X_i}{X_t}\, V_i \;;\; \%E = -\left[\frac{K^2(1-K)}{K(1-K)+\left(\frac{Rm}{Rp}\right)}\right];\; E = V_i\left[\frac{K^2(K-1)}{K(1-K)+\frac{Rm,}{Rp}}\right]$$

$$K_s = \frac{V_o}{X_i} = \frac{V_i}{X_t} \;;\; V_{i\,max} = \sqrt{P\,Rp} \;;\quad \frac{Vo}{Vi} = \frac{K}{\left[k(1-K)\left(\frac{Rp}{Rm}\right)+1\right]} \;;$$

$$E_{max} = 0.15\left(\frac{Rp}{Rm}\right)\% \;;\; R_T = R_{T_o}\left[1+\alpha_{T_o}\,\Delta T\right];\; R_T = a\,R_{T_o}\exp\left(\frac{b}{T}\right) \;;$$

$$R_T = R_{T_o}\left[1+\alpha_{T_o}\,\Delta T + \alpha_{T_1}\,\Delta T^2\right]; \quad R_{T2} = R_{T1}\exp\left[\beta\left(\frac{1}{T2}-\frac{1}{T1}\right)\right] \;;\; C = \varepsilon_o \varepsilon_r \frac{A}{d} \;;$$

$$S_d = \frac{\partial C}{\partial d} = -\varepsilon_o\varepsilon_r\frac{A}{d^2} \;;\quad S_L = \frac{\partial C}{\partial L} = \varepsilon_o\varepsilon_r\frac{W}{d}; \quad G_f = \frac{\frac{\Delta R}{R}}{\frac{\Delta L}{L}} \;;\quad \nu = -\frac{\frac{\Delta d}{d}}{\frac{\Delta L}{L}} \;;$$

$$G_f = 1 + 2\nu + \frac{\frac{\Delta\rho}{\rho}}{\frac{\Delta L}{L}} \quad : \quad V_o = \frac{Q}{C}, \quad Q = F*K_c, \quad F = A*E*\frac{\Delta t}{t}, \quad K_{vc} = \frac{K_c}{\varepsilon_o\varepsilon_r} \;;$$

$$V_o = K_{vc} * t * P \;; \quad R = R1\frac{R3}{R2}, \quad \frac{\Delta R}{R} = 2\varepsilon \;; \quad r = \frac{t}{2}\left[\frac{1+\alpha_B(T2-T1)}{(\alpha_A-\alpha_B)(T2-T1)}\right]$$

$$r = \frac{t\left[3\,(1+m)^2 + (1+mn)\left(m^2+\frac{1}{mn}\right)\right]}{6\,(\alpha_h-\alpha_l)(T2-T1)(1+m)^2} \;;\quad m = \frac{t_{low\_\alpha}}{t_{high\_\alpha}} \;;\quad Re = \frac{\rho\, U_{2act}\, d_2}{\mu}$$

$$u_{2_{th}} = \left\{\frac{2g\left[\left(\frac{P1-P2}{\gamma_f}\right)+(z1-z2)\right]}{1-\left(\frac{A2}{A1}\right)^2}\right\}^{\frac{1}{2}} \;;\quad \dot{Q}_{act} = C_D A_2 u_{2_{th}} \;;\; M = \frac{1}{\sqrt{1-\beta^4}} \;;\quad \beta = \frac{d_2}{D_1} \;;$$

$$U = C_v\sqrt{\left[\frac{2}{\rho}(P_s - P_0)\right]} \;;\quad \left(\frac{P1-P2}{\gamma_f}\right)+(z1-z2) = h_m\left(\frac{\gamma_m}{\gamma_f}-1\right) \;;\quad k = C_d * M \;;$$

$$\dot{W}_p = \dot{Q}\frac{\Delta P_{loss}}{\eta_p} \;;\quad Cost = \dot{W}_p * \text{Tariff Rate} * \text{time} \;;\quad SG_f = \frac{\rho_f}{\rho_{H2O}} \;;\; \gamma_f = \rho_f\, g$$

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