KISS RC Curve Math (Caution: Still needs sorted)

$$x = input, \quad r = RC\ Rate, \quad \alpha_r = Rate, \quad \rho_r = RC\ Curve$$
$$-1 \le x \le 1, \quad 0 \le \rho_r \le 1$$
$$X = 10^3 \cdot x, \qquad G = 1 - |x| \cdot \alpha_r, \qquad C = \frac{X^2}{10^6} = x^2$$
$$S = \left(x \cdot C \cdot \rho_r + x \cdot (1 - \rho_r)\right) \cdot \left(\frac{r}{10}\right)$$
$$y = round\left(\left(\frac{2000}{G}\right) \cdot S \cdot 100\right)/100$$
$$y = round\left(\left(\frac{2000}{1 - |x| \cdot \alpha_r}\right) \cdot S \cdot 100\right)/100 = round\left(\left(\frac{2000}{1 - |x| \cdot \alpha_r}\right) \cdot \left(x \cdot C \cdot \rho_r + x \cdot (1 - \rho_r)\right)\left(\frac{r}{10}\right) \cdot 100\right)/100$$
$$round\left(\left(\frac{2000}{1 - |x| \cdot \alpha_r}\right) \cdot \left(x \cdot x^2 \cdot \rho_r + x \cdot (1 - \rho_r)\right)\left(\frac{r}{10}\right) \cdot 100\right)/100$$
$$f(x, r, \rho_r) = x^3\left(\frac{r}{10}\right) \cdot \rho_r + x \cdot (1 - \rho_r)\left(\frac{r}{10}\right) = [\rho_r \cdot x^3 + (1 - \rho_r) \cdot x]\left(\frac{r}{10}\right)$$
$$f(x, r, \rho_r) = [\rho_r \cdot x^3 + (1 - \rho_r) \cdot x]\left(\frac{r}{10}\right)$$
$$e(x, \alpha_r) = \frac{2000}{1 - |x| \cdot \alpha_r} = \frac{2000}{1 - |x| \cdot \alpha_r}$$

$$y(x; r, \alpha_r, \rho_r) = round\left(e(x, \alpha_r) \cdot f(x, r, \rho_r)\right)/100$$
$$y(x) = \frac{200r}{1 - \alpha_r \cdot x}[\rho_r \cdot x^3 + \overline{\rho_r} \cdot x], \quad \overline{\rho_r} + \rho_r = 1$$
$$\frac{dY}{dx} = 200r\left(\frac{(3\rho_r x^2 + \overline{\rho_r})(1 - \alpha_r \cdot x) - (-\alpha_r)(\rho_r \cdot x^3 + \overline{\rho_r} \cdot x)}{1 - \alpha_r \cdot x}\right)$$
$$\frac{dY}{dx}(0) = 200r\left(\frac{(0 + \overline{\rho_r})(1 - \alpha_r \cdot 0) - (-\alpha_r)(\rho_r \cdot 0 + \overline{\rho_r} \cdot 0)}{1}\right) = 200r(1 - \rho_r)$$
$$\frac{dY}{dx}(1) = 200r\left(\frac{(3\rho_r + \overline{\rho_r})(1 - \alpha_r) - (-\alpha_r)(\rho_r + \overline{\rho_r})}{1 - \alpha_r}\right) = 200r\left(\frac{(1 + 2\rho_r)(1 - \alpha_r) - (-\alpha_r)}{1 - \alpha_r}\right)$$
$$= 200r\left(\frac{(1 + 2\rho_r)(1 - \alpha_r) - (-\alpha_r)}{1 - \alpha_r}\right) = 200r\left(\frac{2\rho_r(1 - \alpha_r) + (1 - \alpha_r) - (-\alpha_r)}{1 - \alpha_r}\right)$$
$$= 200r\left(\frac{2\rho_r(1 - \alpha_r) + 1}{1 - \alpha_r}\right) = 200r\left(2\rho_r + \frac{1}{1 - \alpha_r}\right)$$
$$Y_1 = \frac{200r}{1 - \alpha_r \cdot 1}[1] = \frac{200r}{1 - \alpha_r}, \quad \boxed{Y_{MAX} = \frac{200r}{1 - \alpha_r}, \quad OR \quad r(\alpha_r) = \frac{1}{200}(1 - \alpha_r) \cdot Y_{MAX}}$$

$$\frac{dY_{MAX}}{dx} = 200r\left(2\rho_r + \frac{1}{1 - \alpha_r}\right), \qquad Y'_{MIN} = \frac{dY_{MIN}}{dx} = 200r(1 - \rho_r)$$
$$Y'_{MIN} = 200(1 - \alpha_r)Y_{MAX}(1 - \rho_r) = 200Y_{MAX} \cdot (1 - (\alpha_r + \rho_r) + \alpha_r\rho_r)$$

$$Y_{MIN1} = 200Y_{MAX}\left((1 - (\alpha_{r1} + \rho_{r1}) + \alpha_{r1}\rho_{r1})\right) = Y_{MIN2} = 200Y_{MAX}\left((1 - (\alpha_{r2} + \rho_{r2}) + \alpha_{r2}\rho_{r2})\right)$$
$$1 - (\alpha_{r1} + \rho_{r1}) + \alpha_{r1}\rho_{r1} = 1 - (\alpha_{r2} + \rho_{r2}) + \alpha_{r2}\rho_{r2}$$
$$\boxed{\rho_{r1}(\alpha_{r1} - 1) - \alpha_{r1} = \rho_{r2}(\alpha_{r2} - 1) - \alpha_{r2}}$$

$$Y_{1,MAX} = \frac{200r_1}{1 - \alpha_{r1}}, \qquad Y_{2,MAX} = \frac{200r_2}{1 - \alpha_{r2}}, \qquad r_1(1 - \alpha_{r2}) = r_2(1 - \alpha_{r1}), \quad \frac{r_1}{r_2} = \frac{1 - \alpha_{r1}}{1 - \alpha_{r2}}$$
$$\frac{dY_{1,MIN}}{dx} = 200r_1(1 - \rho_{r1}), \quad \frac{dY_{2,MIN}}{dx} = 200r_2(1 - \rho_{r2}), \quad r_1(1 - \rho_{r1}) = r_2(1 - \rho_{r2}), \quad \frac{r_1}{r_2} = \frac{1 - \rho_{r2}}{1 - \rho_{r1}}$$

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$\frac{r_1}{r_2} = \frac{1-\alpha_{r1}}{1-\alpha_{r2}}, \quad \frac{r_1}{r_2} = \frac{1-\rho_{r2}}{1-\rho_{r1}}, \qquad \frac{1-\alpha_{r1}}{1-\alpha_{r2}} = \frac{1-\rho_{r2}}{1-\rho_{r1}}, \qquad (1-\alpha_{r1})(1-\rho_{r1}) = (1-\alpha_{r2})(1-\rho_{r2})$

$$\frac{dY}{dx} = 200r\left(\frac{(3\rho_r x^2 + \overline{\rho_r})(1-\alpha_r \cdot x) - (-\alpha_r)(\rho_r \cdot x^3 + \overline{\rho_r} \cdot x)}{(1-\alpha_r \cdot x)^2}\right)$$