$$B = \frac{1}{\beta}\ \text{imag}\left[\lim_{S\to\alpha+i\beta} \left[(S-\alpha)^2+\beta^2\right] \frac{N(S)}{D(S)}\right] \qquad S=\alpha+i\beta$$

$S = -\xi w_n + i\, w_d$

$$B = \frac{1}{w_d}\ \text{imag}\left[\lim_{S\to\alpha+i\beta} \frac{W_n^2 P}{S^2+PS}\right] \to \frac{1}{w_d}\ \text{ima}\left[\frac{W_n^2 P}{(-\xi w_n + i w_d)^2 - \xi w_n P + j w_d P}\right]$$

$$B = \frac{1}{w_d}\ \text{imag}\left[\frac{W_n^2 P}{\xi^2 w_n^2 - w_d^2 - j2\xi w_n w_d - \xi w_n P + j w_d P}\right]$$

$$B = \frac{1}{w_d}\ \text{imag}\left[\frac{W_n^2 P}{\xi^2 W_n^2 - W_d^2 - \xi W_n P + j\left(w_d P - 2\xi W_n W_d\right)}\right]$$ Multiplica por el conjugado

$$B = \frac{1}{w_d}\ \text{imag}\left[\frac{P w_n^2\left(\xi^2 W_n^2 - \xi W_n P - W_d^2\right) + jP w_d W_n (2\xi W_n - P)}{\xi^4 W_n^4 - 2\xi^3 W_n^3 P + \xi^2 (P^2 + 2W_d^2) W_n^2 - 2\xi P W_d^2 W_n + (P^2 + W_d^2) W_d^2}\right]$$

Extrayendo la Componente imaginaria

$$B = \frac{P W_n^2 (2\xi W_n - P)}{\xi^4 W_n^4 - 2\xi^3 W_n^3 P + \xi^2 (P^2 + 2W_d^2) W_n^2 - 2\xi P W_d^2 W_n + (P^2 + W_d^2) W_d^2}$$

$\hookrightarrow W_d = W_n\sqrt{1-\xi^2}$

$$\boxed{B = \frac{P^2 - 2\xi W_n P}{2\xi W_n P - P^2 - W_n^2}}$$

$$\frac{B\alpha + C}{\beta} = \frac{1}{\beta}\ \text{real}\left[\lim_{S\to\alpha+i\beta} \left[(S-\alpha)^2+\beta^2\right] \frac{N(S)}{D(S)}\right]$$

Extrayendo Parte Real

$$\frac{B\alpha + C}{\beta} = \frac{1}{W_d}\left[\frac{P W_n^2\left(\xi^2 W_n^2 - \xi W_n P - W_d^2\right)}{\xi^4 W_n^4 - 2\xi^3 W_n^3 P + \xi^2 (P^2 + 2W_d^2) W_n^2 - 2\xi P W_d^2 W_n + (P^2 + W_d^2) W_d^2}\right]$$

$$\boxed{\frac{B\alpha + C}{\beta} = \frac{-\left(2\xi^2 W_n - \xi P - W_n\right) P W_n}{\left(2\xi P W_n - P^2 - W_n^2\right)\sqrt{1-\xi^2}\ W_n}}$$

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$$A = \lim_{s \to 0} \frac{\omega_n^2 P}{(s^2 + 2\xi\omega_n s + \omega_n^2)(s+P)} = 1$$

$$D = \lim_{s \to -p} \frac{\omega_n^2 P}{s(s^2 + 2\xi\omega_n s + \omega_n^2)}$$

$$D = \frac{\omega_n^2 \cancel{P}}{-\cancel{P}(P^2 - 2\xi\omega_n P + \omega_n^2)} =$$

$$\boxed{D = \frac{-\omega_n^2}{P^2 - 2\xi\omega_n P + \omega_n^2}}$$

Respuesta Transitoria (temporal)

$$\boxed{y(t) = A + B e^{-\xi\omega_n t} \cos(\omega_d t) + \frac{B\alpha + C}{\beta} e^{-\xi\omega_n t} \sin(\omega_d t) + D e^{-pt}}$$

$$\omega_d = \omega_n \sqrt{1 - \xi^2}$$