f) $H(z) = (1 - C_1 z^{-N}) \dfrac{b_0 + b_1 z^{-1} + b_2 z^{-2}}{\frac{1}{a_0} - a_1 z^{-1} - a_2 z^{-2}}$; $a_0 = 1$, $a_1 = -R$, $a_2 = 0$, $C = 0$; $b_0 = R$, $b_1 = 1$, $b_2 = 0$; $R = \dfrac{-D}{D+2}$, $D \in [-0{,}5\,;\ +0{,}5]$

$\hookrightarrow H(z) = \dfrac{R + z^{-1}}{1 + R z^{-1}} \Rightarrow H(e^{-j\Omega}) = \dfrac{R - 1 + 1 + e^{-j\Omega}}{1 + e^{-j\Omega} + (R-1)e^{-j\Omega}} = \dfrac{\cancel{e^{-j\Omega/2}}}{\cancel{e^{-j\Omega/2}}} \dfrac{e^{j\Omega/2} + e^{-j\Omega/2} + (R-1)e^{j\Omega/2}}{e^{j\Omega/2} + e^{-j\Omega/2} + (R-1)e^{-j\Omega/2}} =$

$$H(e^{+j\Omega}) = \frac{2\cos(\Omega/2) + (R-1)\cos(\Omega/2) + j(R-1)\,\mathrm{sen}(\Omega/2)}{2\cos(\Omega/2) + (R-1)\cos(\Omega/2) - j(R-1)\,\mathrm{sen}(\Omega/2)} =$$

$$= \frac{(R+1)\cos(\Omega/2) + j(R-1)\,\mathrm{sen}(\Omega/2)}{(R+1)\cos(\Omega/2) - j(R-1)\,\mathrm{sen}(\Omega/2)}$$

$\hookrightarrow |H(\Omega)|^2 = \dfrac{(R+1)^2\cos^2(\Omega/2) + (R-1)^2\mathrm{sen}^2(\Omega/2)}{(R+1)^2\cos^2(\Omega/2) + (R-1)^2\mathrm{sen}^2(\Omega/2)} = 1 \Rightarrow \boxed{|H(\Omega)| = 1}$

$\varphi(\Omega) = \mathrm{arctg}\left[\dfrac{R-1}{R+1}\,\mathrm{tg}(\Omega/2)\right] + \mathrm{arctg}\left[+\dfrac{R-1}{R+1}\,\mathrm{tg}(\Omega/2)\right] = \boxed{2\,\mathrm{arctg}\left[\dfrac{R-1}{R+1}\,\mathrm{tg}(\Omega/2)\right]}$

$-\dfrac{d\varphi(\Omega)}{d\Omega} = \tau(\Omega) = -\cancel{2}\, \dfrac{1}{1 + \frac{(R-1)^2}{(R+1)^2}\mathrm{tg}^2(\Omega/2)} \left(\dfrac{R-1}{R+1}\right) \dfrac{1}{\cancel{2}\cos^2(\Omega/2)} =$

$= \dfrac{1-R}{1+R} \dfrac{1}{\cos^2(\Omega/2) + \left(\frac{1-R}{1+R}\right)^2 \mathrm{sen}^2(\Omega/2)}$; $\boxed{R = \dfrac{-D}{D+2} \Rightarrow \dfrac{1-R}{1+R} = \dfrac{1 + \frac{D}{D+2}}{1 - \frac{D}{D+2}} = \dfrac{2D+2}{2} = D+1}$

$\Rightarrow \boxed{\tau(\Omega) = \dfrac{1}{\frac{1}{D+1}\cos^2(\Omega/2) + (D+1)\,\mathrm{sen}^2(\Omega/2)}}$

$\hookrightarrow \Omega = 0 \rightarrow \boxed{\tau(\Omega=0) = D+1}$

MARGEN 5% RESPECTO DE $\tau(\Omega=0) = D+1$

$0{,}95 < \dfrac{\tau(\Omega)}{\tau(0)} < 1{,}05$

$0{,}95 < \dfrac{1}{D+1} \dfrac{1}{\frac{1}{D+1}\cos^2(\Omega/2) + (D+1)\,\mathrm{sen}^2(\Omega/2)} < 1{,}05$

$0{,}95 < \dfrac{1}{\cos^2(\Omega/2) + (D+1)^2\mathrm{sen}^2(\Omega/2)} < 1{,}05$

$\dfrac{20}{19} > \cos^2(\Omega/2) + (D^2+2D)\,\mathrm{sen}^2(\Omega/2) + \mathrm{sen}^2(\Omega/2) < \dfrac{20}{21}$

$\dfrac{20}{19} > 1 + (D^2+2D)\,\mathrm{sen}^2(\Omega/2) > \dfrac{20}{21}$

$\rightarrow \dfrac{1}{19} > (D^2+2D)\,\mathrm{sen}^2(\Omega/2) > -\dfrac{1}{21}$

$\hookrightarrow \mathrm{sen}^2(\Omega/2) \geq 0$

$\hookrightarrow (D^2+2D) \begin{cases} > 0 & \text{si } D > 0 \\ < 0 & \text{si } D < 0 \\ = 0 & \text{si } D = 0 \end{cases}$

$\hookrightarrow \underline{D > 0} \Rightarrow \boxed{\Omega < 2\,\mathrm{arcsen}\left[\sqrt{\dfrac{1}{19(D^2+2D)}}\right]}$

$\hookrightarrow \underline{D < 0} \Rightarrow \boxed{\Omega > 2\,\mathrm{arcsen}\left[\sqrt{\dfrac{1}{-21(D^2+2D)}}\right]}$