$T_P := 10.4\ s$ $H_s := 4.3\ m$ $d := 30\ m$

$TT := 3\ hr$

You defined T later differently depending on ω, so I renamed that variable which you seem to use just in the very last region

$\delta\omega := 0.01$ $n := 400$

If you really need ω up to 40 rad/s then change to n:=4000

$$\omega_p := \frac{2 \cdot \pi}{T_P} = 0.604\ \frac{rad}{s}$$

$$\varphi := \frac{T_P}{\sqrt[2]{H_s}} = 5.015\ \frac{s}{m^{\frac{1}{2}}}$$

$$c := \begin{cases} 5 & \text{if } \dfrac{T_P}{\sqrt[2]{H_s}} \le 3.6\ \dfrac{s}{m^{\frac{1}{2}}} \\ \exp\left(5.75 - 1.15 \cdot \dfrac{\sqrt[2]{m}}{s} \cdot \dfrac{T_P}{\sqrt[2]{H_s}}\right) & \text{if } 3.6\ \dfrac{s}{m^{\frac{1}{2}}} < \dfrac{T_P}{\sqrt[2]{H_s}} < 5\ \dfrac{s}{m^{\frac{1}{2}}} \\ 1 & \text{if } \dfrac{T_P}{\sqrt[2]{H_s}} \ge 5\ \dfrac{s}{m^{\frac{1}{2}}} \end{cases} = 1$$

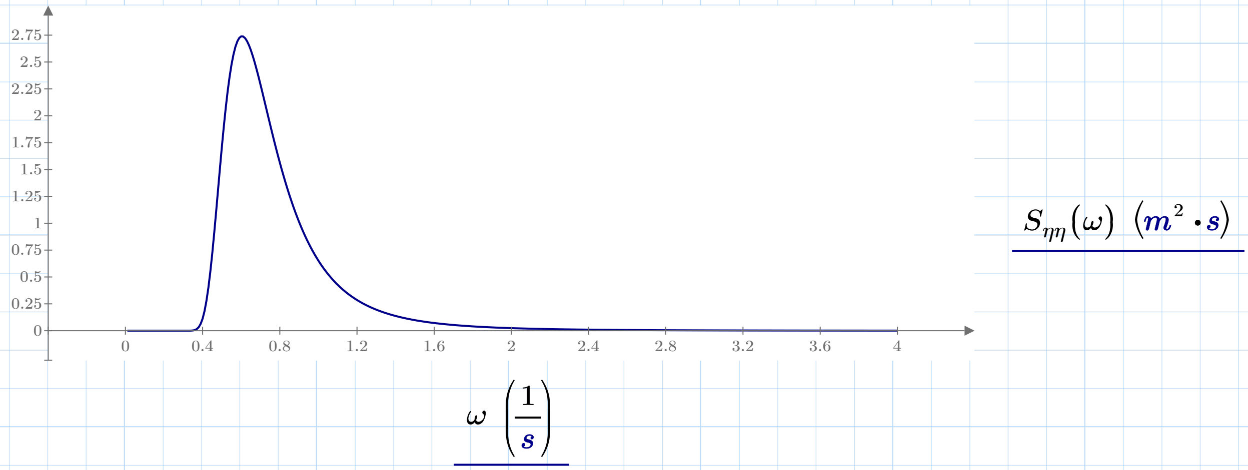
$$\sigma(\omega) := \begin{cases} 0.07 & \text{if } \omega \le \omega_p \\ 0.09 & \text{else} \end{cases}$$

$$\alpha := \frac{5}{16} \cdot \frac{H_s^{\,2} \cdot \omega_p^{\,4}}{g^2} \cdot (1 - 0.278\ \ln(c)) = 0.008$$

α is not dependend on ω so why did you made it a function of ω ?

$$S_{\eta\eta}(\omega) := \alpha \cdot g^2 \cdot \omega^{-5} \cdot \exp\left(-\frac{5}{4}\left(\frac{\omega}{\omega_p}\right)^{-4}\right) \cdot c^{\exp\left(-0.5\left(\frac{\omega - \omega_p}{\sigma(\omega) \cdot \omega_p}\right)^2\right)}$$

$$\omega := 0 \cdot \frac{1}{s}, \delta\omega \cdot \frac{1}{s} .. n \cdot \delta\omega \cdot \frac{1}{s}$$ range, only uses for plotting

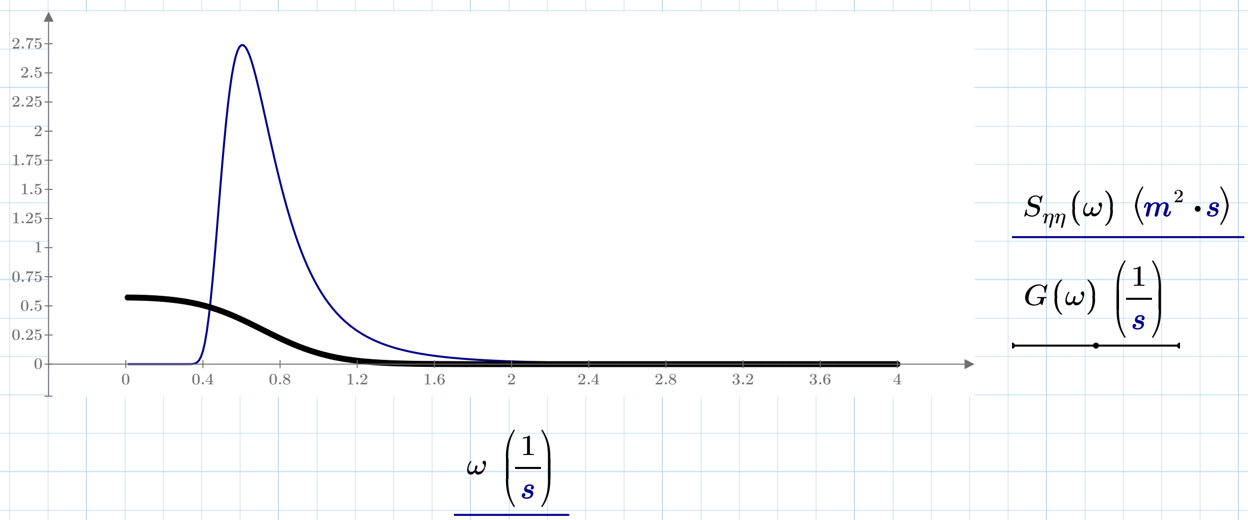


$$T(\omega) := \frac{2 \cdot \pi}{\omega}$$

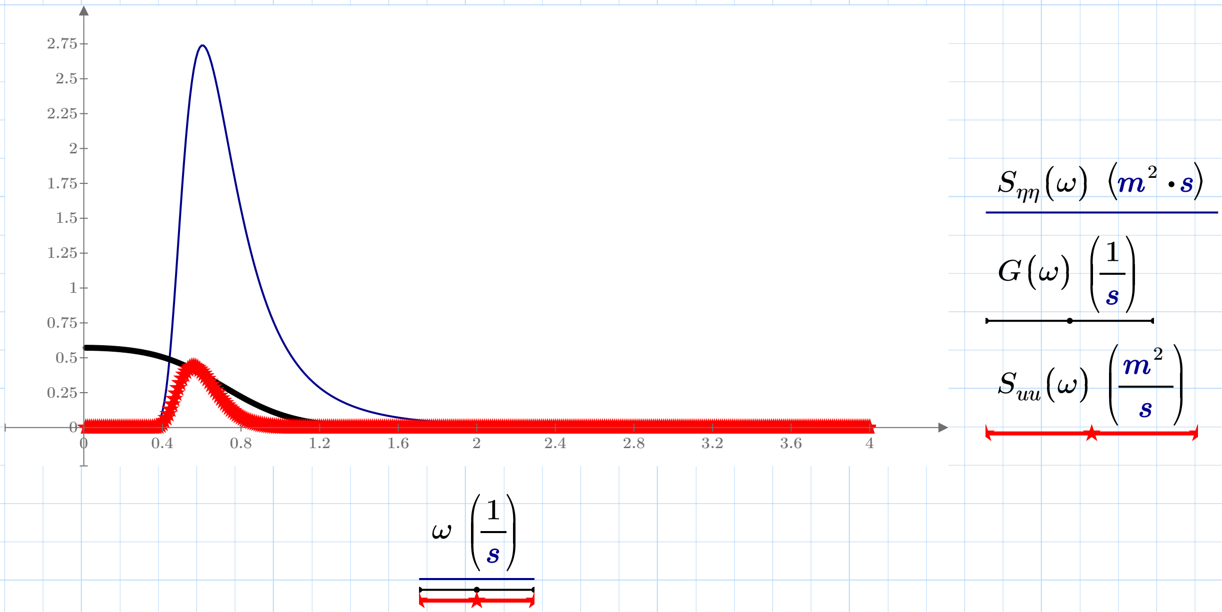
$$L(\omega) := \frac{g \cdot (T(\omega))^2}{2 \cdot \pi} \cdot \sqrt{\tanh\left(\frac{4 \cdot \pi^2}{(T(\omega))^2} \cdot \frac{d}{g}\right)}$$

$$k(\omega) := \frac{2 \cdot \pi}{L(\omega)}$$

$$G(\omega) := \frac{\omega}{\sinh(k(\omega) \cdot d)}$$



$$S_{uu}(\omega) := (G(\omega))^2 \cdot S_{\eta\eta}(\omega)$$



$$M_0 := \int_0^{\frac{2}{s}} \omega^0 \cdot S_{uu}(\omega)\, d\omega \qquad M_0 = 0.11\ \frac{m^2}{s^2}$$

$$M_1 := \int_0^{\frac{2}{s}} \omega^1 \cdot S_{uu}(\omega)\, d\omega \qquad M_1 = 0.066\ \frac{m^2}{s^3}$$

$$M_2 := \int_{\frac{0}{s}}^{\frac{2}{s}} \omega^2 \cdot S_{uu}(\omega)\, d\omega \qquad M_2 = 0.041\ \frac{m^2}{s^4}$$

$$U_s := \sqrt[2]{M_0} \qquad U_s = 0.332\ \frac{m}{s}$$

$$T_u := 2 \cdot \pi \cdot \sqrt[2]{\frac{M_0}{M_2}} \qquad T_u = 10.229\ s$$

$$\tau := \frac{TT}{T_u} \qquad \tau = 1.056 \cdot 10^3$$

Not sure if this is what you had in mind - I used the variable TT which you defined at the beginning as T in your sheet