Name: Mahmoud Magdy Mahmoud **ID: 3432**

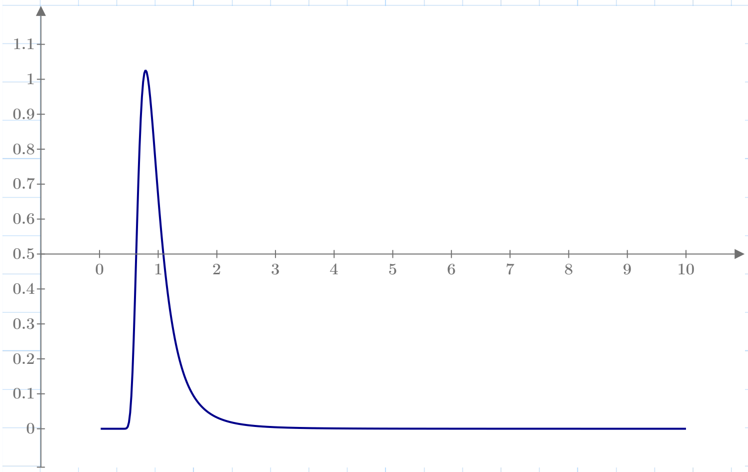
Bretschneider Spectrum:

$H_s := 3\ m$

$T_p := 8\ s$

$T_1 := 0.772 \cdot T_p = 6.176\ s$

$$S_\zeta(\omega) := \frac{173 \cdot H_s^{\,2}}{T_1^{\,4}} \cdot \omega^{-5} \cdot \exp\left(\frac{-692}{T_1^{\,4}} \cdot \omega^{-4}\right)$$



$S_\zeta\left(\omega \cdot \frac{rad}{s}\right)\ (m^2 \cdot s)$

ω

$\frac{2}{0.01} = 200$

$\Delta\omega := 0.01\ \frac{rad}{s}$

$n := 200$

$i := 1..n$

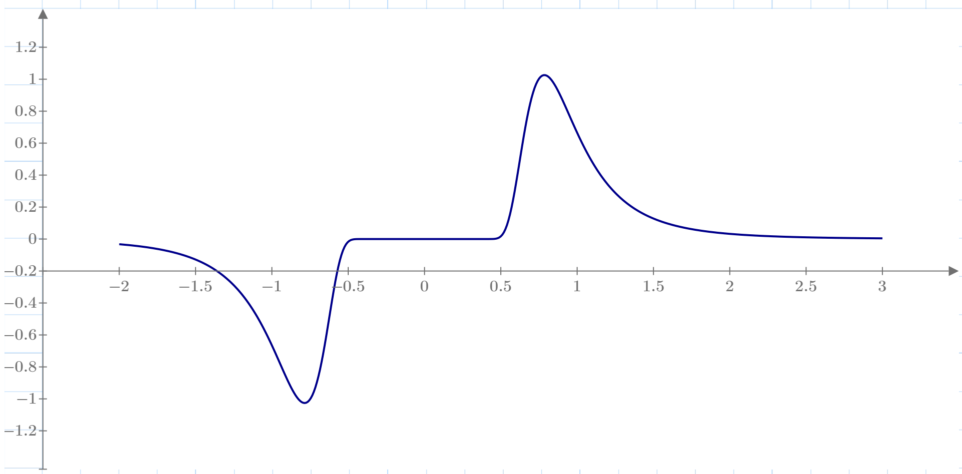
$$i = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \\ \vdots \end{bmatrix}$$

$\omega_i := i \cdot \Delta\omega$

$$\omega_i = \begin{bmatrix} \vdots \\ 0.07 \\ 0.08 \\ 0.09 \\ 0.1 \\ 0.11 \\ 0.12 \\ 0.13 \\ 0.14 \\ 0.15 \\ 0.16 \\ 0.17 \\ 0.18 \\ \vdots \end{bmatrix} \frac{1}{s}$$

$end := \max(\omega) = 2\ \frac{1}{s}$

$$S_i := S_\zeta(\omega_i) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \vdots \end{bmatrix} m^2 \cdot s$$



$S_\zeta\left(w \cdot \frac{rad}{s}\right) \; (m^2 \cdot s)$

w

$$m0 := \sum_{i=1}^{n} \left| (\omega_i)^0 \cdot S_i \cdot \Delta\omega \right| = 0.546 \; m^2$$

$$m1 := \sum_{i=1}^{n} \left| (\omega_i)^1 \cdot S_i \cdot \Delta\omega \right| = 0.529 \; \frac{m^2}{s}$$

$$m2 := \sum_{i=1}^{n} \left| (\omega_i)^2 \cdot S_i \cdot \Delta\omega \right| = 0.556 \; \frac{m^2}{s^2}$$

$$m3 := \sum_{i=1}^{n} \left| (\omega_i)^3 \cdot S_i \cdot \Delta\omega \right| = 0.637 \; \frac{m^2}{s^3}$$

$$RMS := \sqrt[2]{\sum_{i=1}^{n} m0} = 10.452\ m$$

$$\zeta_{sig} := 2 \cdot RMS = 20.903\ m$$

$$H_{sig} := 2 \cdot \zeta_{sig} = 41.807\ m$$

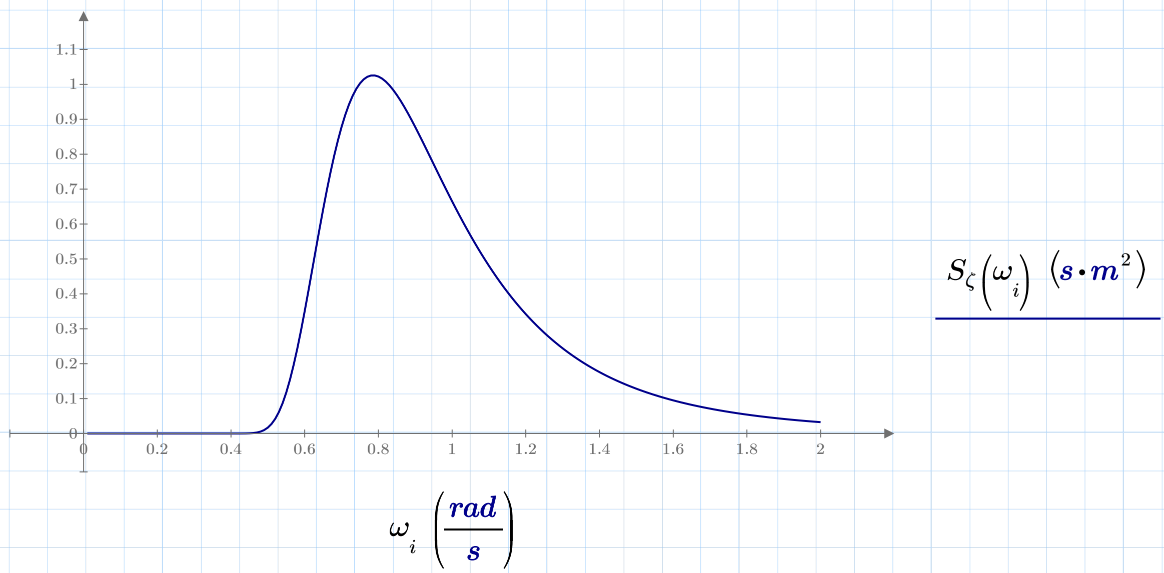
$$T_1 := 2 \cdot \pi \cdot \frac{\sum_{i=1}^{n} m0}{\sum_{i=1}^{n} m1} = 6.491\ s$$

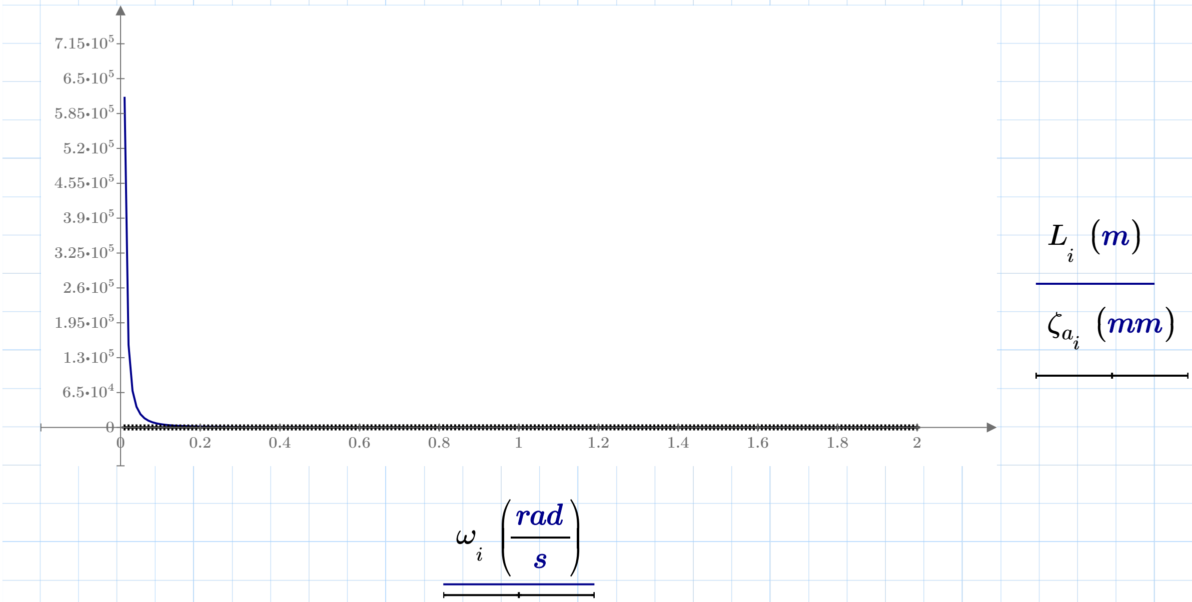
$$k_i := \frac{{\omega_i}^2}{g} = \begin{bmatrix} 1.02 \cdot 10^{-5} \\ 4.079 \cdot 10^{-5} \\ 9.177 \cdot 10^{-5} \\ 1.632 \cdot 10^{-4} \\ 2.549 \cdot 10^{-4} \\ 3.671 \cdot 10^{-4} \\ 4.997 \cdot 10^{-4} \\ 6.526 \cdot 10^{-4} \\ 8.26 \cdot 10^{-4} \\ 0.001 \\ 0.001 \\ 0.001 \\ \vdots \end{bmatrix} \frac{1}{m}$$

$$L_i := \frac{2\ \pi}{k_i} = \begin{bmatrix} 6.162 \cdot 10^{5} \\ 1.54 \cdot 10^{5} \\ 6.846 \cdot 10^{4} \\ 3.851 \cdot 10^{4} \\ 2.465 \cdot 10^{4} \\ 1.712 \cdot 10^{4} \\ 1.257 \cdot 10^{4} \\ 9.628 \cdot 10^{3} \\ 7.607 \cdot 10^{3} \\ 6.162 \cdot 10^{3} \\ 5.092 \cdot 10^{3} \\ 4.279 \cdot 10^{3} \\ \vdots \end{bmatrix} m$$

$$\zeta_{a_i} := \left(2 \cdot \sqrt[2]{S_i \cdot \Delta\omega}\right) = \begin{bmatrix} \vdots \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 5.096 \cdot 10^{-157} \\ 3.783 \cdot 10^{-123} \\ 6.163 \cdot 10^{-98} \\ 7.34 \cdot 10^{-79} \\ 3.243 \cdot 10^{-64} \\ 7.997 \cdot 10^{-53} \\ \vdots \end{bmatrix} m$$

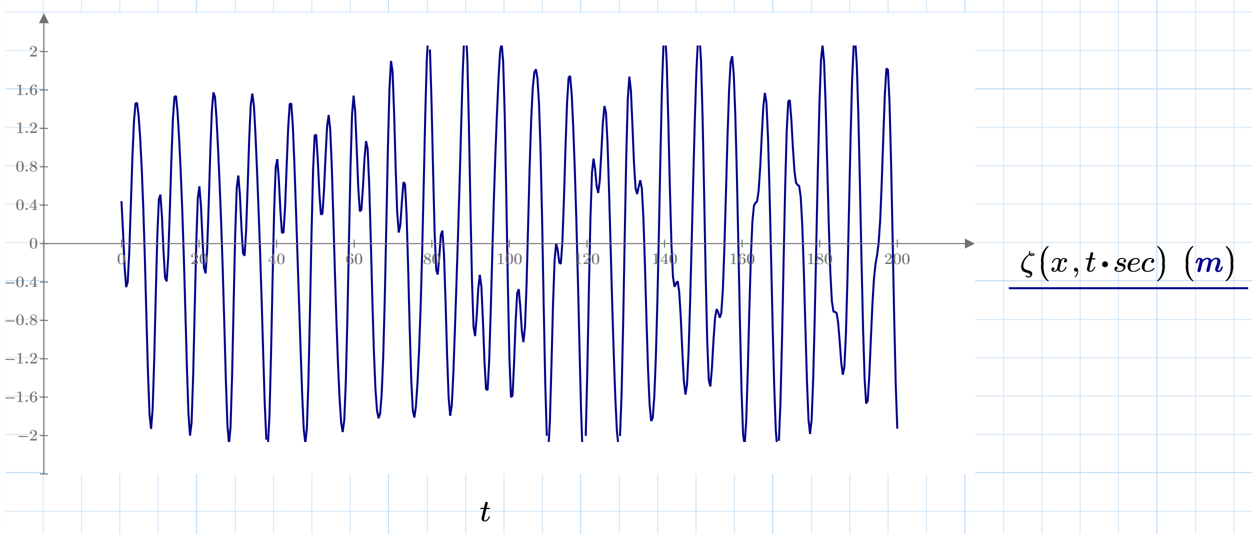
$$\max\left(\zeta_a\right) = 0.203\ m$$





$$\zeta(x,t) := \sum_{n=1}^{n} \left(\zeta_{a_n} \cdot \cos\left(k_n \cdot x - \omega_n \cdot t\right)\right)$$

$x := 5000\ m$ $\quad H_s = 3\ m$ $\quad \zeta(x, 1\ sec) = -0.373\ m$



Jonswap Spectrum:

$$\frac{T_p}{\sqrt[2]{H_s}} = 4.619\ \frac{s}{m^{\frac{1}{2}}}$$

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

c needs to be a function of T and H for this to work below this point for different T and H

$$c := \exp\left(5.75 - 1.15 \cdot \frac{\sqrt[2]{m}}{s} \cdot \frac{T_p}{\sqrt[2]{H_s}}\right)$$

$$A_c := 1 - 0.287\ \ln(c) = 0.874$$

$$\omega_p := \frac{2\ \pi}{T_p} = 0.785\ \frac{1}{s}$$

$$\omega = \begin{bmatrix} 0.01 \\ 0.02 \\ 0.03 \\ 0.04 \\ 0.05 \\ 0.06 \\ 0.07 \\ 0.08 \\ 0.09 \\ 0.1 \\ 0.11 \\ 0.12 \\ \vdots \end{bmatrix} \frac{1}{s}$$

$$\omega_n = 2\ \frac{1}{s}$$

$$\sigma_i := \begin{cases} \text{if } \omega_i \le \omega_p \\ \quad 0.07 \\ \text{if } \omega_i > \omega_p \\ \quad 0.09 \end{cases} = ?$$

$$\sigma := 0.09$$

$$S_{PM}(\omega) := \frac{5}{16} \cdot H_s^{\ 2} \cdot \omega_p^{\ 4} \cdot \omega^{-5} \cdot \exp\left(\frac{-5}{4} \left(\frac{\omega}{\omega_p}\right)^{-4}\right)$$

$$S_J(\omega) := A_c \cdot \left(\frac{5}{16} \cdot H_s^{\ 2} \cdot \omega_p^{\ 4} \cdot \omega^{-5} \cdot \exp\left(\frac{-5}{4} \left(\frac{\omega}{\omega_p}\right)^{-4}\right)\right) \cdot c^{\exp\left(-0.5 \left(\frac{\omega - \omega_p}{\sigma \cdot \omega_p}\right)^2\right)}$$

$$S_J(\omega_6) = 0\ m^2 \cdot s$$

$$S_{JJ_i} := S_J(\omega_i) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \vdots \end{bmatrix} m^2 \cdot s$$

$$m0_J := \sum_{i=1}^{n} \left| \left(\omega_i\right)^0 \cdot S_{JJ_i} \cdot \Delta\omega \right| = 0.554\ m^2$$

$$m1_J := \sum_{i=1}^{n} \left| \left(\omega_i\right)^1 \cdot S_{JJ_i} \cdot \Delta\omega \right| = 0.522\ \frac{m^2}{s}$$

$$m2_J := \sum_{i=1}^{n} \left| \left(\omega_i\right)^2 \cdot S_{JJ_i} \cdot \Delta\omega \right| = 0.533\ \frac{m^2}{s^2}$$

$$m3_J := \sum_{i=1}^{n} \left| \left(\omega_i\right)^3 \cdot S_{JJ_i} \cdot \Delta\omega \right| = 0.595\ \frac{m^2}{s^3}$$

$$m4_J := \sum_{i=1}^{n} \left| \left(\omega_i\right)^4 \cdot S_{JJ_i} \cdot \Delta\omega \right| = 0.727\ \frac{m^2}{s^4}$$

$$T_z := \left(0.6673 \cdot T_p\right) + \left(0.05037 \cdot c \cdot T_p\right) - \left(0.006230 \cdot c^2 \cdot T_p\right) + \left(0.0003341 \cdot c^3\ s\right) = 5.845\ s$$

$$T1 := \left(0.7303 \cdot T_p\right) + \left(0.04936 \cdot c \cdot T_p\right) - \left(0.006556 \cdot c^2 \cdot T_p\right) + \left(0.0003610 \cdot c^3\ s\right) = 6.33\ s$$

$$S_{JJ}^{\mathrm{T}} = [0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ 0\ \ \ldots]\ mm^2 \cdot s \qquad \max\left(S_{JJ}\right) = 1.389\ m^2 \cdot s$$

$$\omega^{\mathrm{T}} = [0.01\ \ 0.02\ \ 0.03\ \ 0.04\ \ 0.05\ \ 0.06\ \ 0.07\ \ 0.08\ \ 0.09\ \ 0.1\ \ 0.11\ \ 0.12\ \ \ldots]\ \frac{rad}{sec}$$

$$\max(\omega) = 2\ \frac{rad}{sec}$$

I think the old graph had set limits too high