13.42 Homework #6 Solutions

1. See Figure 1 below:

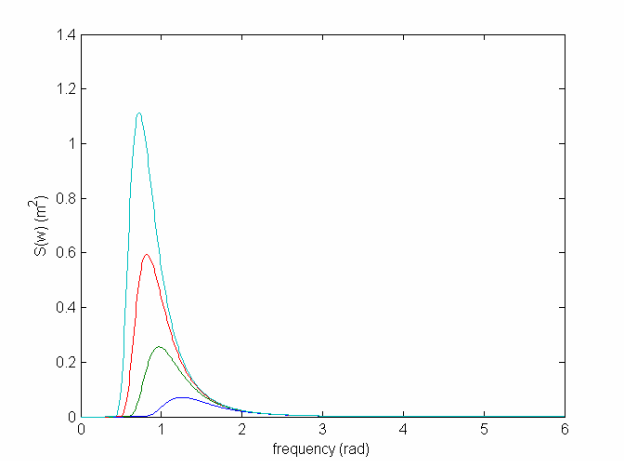

Figure 1 – Bretschneider spectrum for four significant wave heights – $\zeta = 1$ meter, $\zeta = 1.667$ meters, $\zeta = 2.333$ meters, and $\zeta = 3$ meters – for *fully developed seas*

2. a. For fully-developed seas of significant wave height $\zeta = 1$ meter (3.28 feet), the corresponding wind velocity is $U = 14$ knots while the minimum fetch is $x =$ 28 nautical miles (see p. 4.43 in Triantafyllou and Chryssostomidis). A comparison between the Bretchneider and JONSWAP spectra, given the above parameters, is shown in Figure 2.

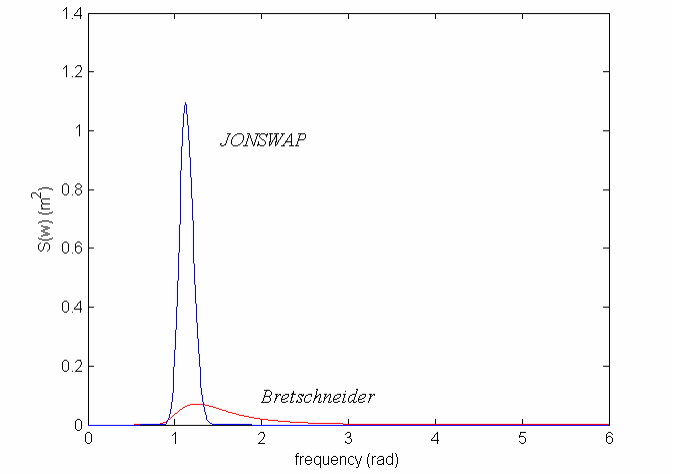

Figure 2 – Bretschneider v. JONSWAP spectra

b. Sea spectra for developing, fully-developed, and decaying sea states are shown in Figure 3.

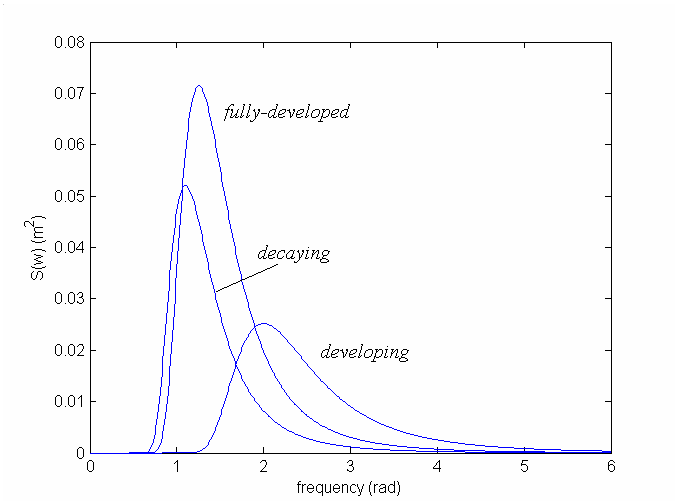

Figure 3 – Bretschneider spectra for developing, fully-developed, and decaying sea states

3. a. For the case of the Bretschneider spectrum of significant wave height $\zeta = 1$ meter, $M_0 = 0.0624$, $M_2 = 0.1837$, and $M_4 = 1.0523$.

   b. $\varepsilon = 0.6969$

   c. $\alpha^{1/N} = 0.5145,\ 0.6822,\ 0.7429$ for $N = 10, 50, 100$.

4. a. See Figure 4.

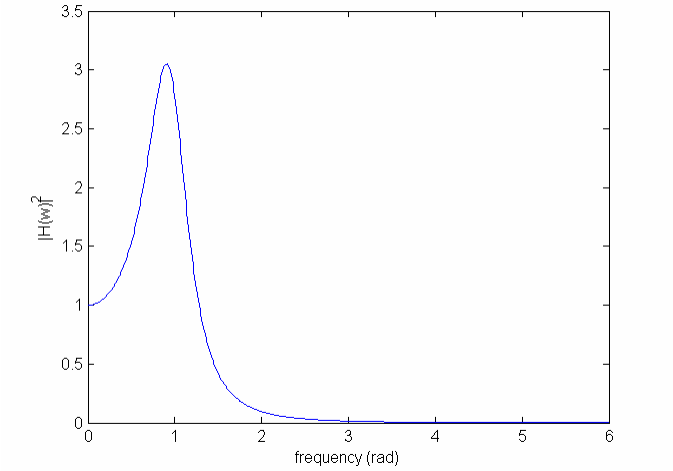

Figure 4 - $|H(\omega)|^2$

b. See Figure 5.

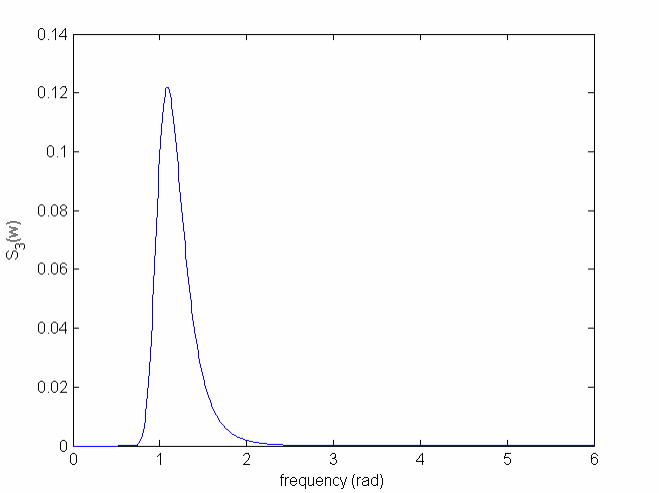

Figure 5 – Spectrum of heave response given input spectrum in 3a.

c. See Figure 6.

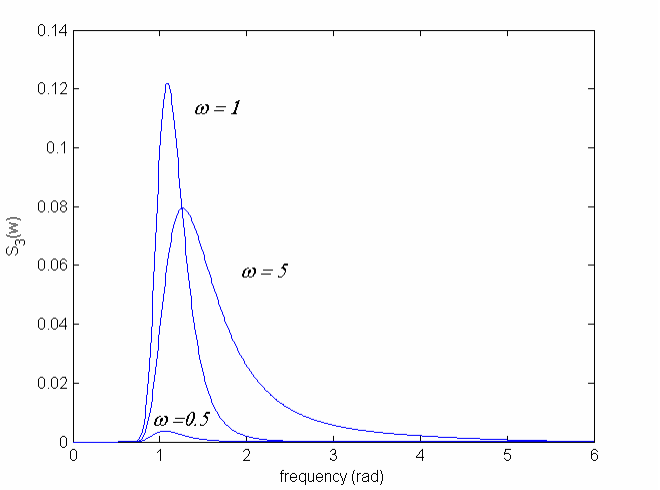

Figure 6 – Spectrum of heave response at different natural frequencies