

Figure 7.9 Process diagram for a feed-water heating system of a boiler.

Example 7.1 Aliasing

Figure 7.9 is a process diagram of feed-water heating in a boiler of a ship. A valve controls the flow of water. There is a backlash in the valve positioner due to wear. This causes the temperature and the pressure to oscillate. Figure 7.10 shows a sampled recording of the temperature and a continuous recording of the pressure.

From the temperature recording one might believe that there is an oscillation with a period of about 38 min. The pressure recording reveals, however, that the oscillation in pressure has a period of 2.11 min. Physically the two variables are coupled and should oscillate with the same frequency.

The temperature is sampled every other minute. The sampling frequency is $\omega_s = 2\pi/2 = 3.142$ rad/min and the frequency of the pressure oscillation is $\omega_0 = 2\pi/2.11 = 2.978$ rad/min. The lowest aliasing frequency is $\omega_s - \omega_0 = 0.1638$ rad/min. This corresponds to a period of 38 min, which is the period of the recorded oscillation in the temperature.

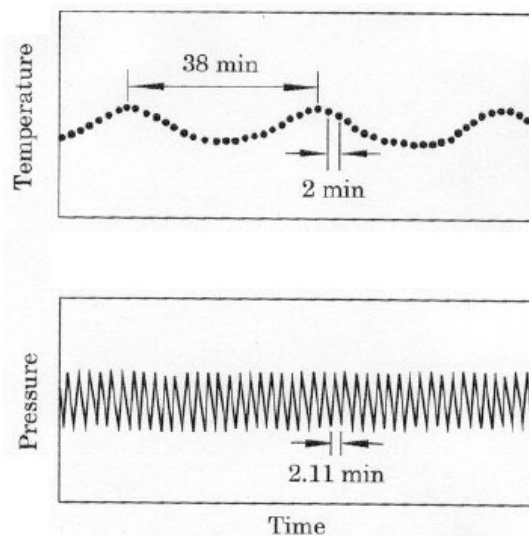


Figure 7.10 Recordings of temperature and pressure.

* h.f. components appear to be l.f. components due to aliasing.