8 Experimental Vibrations

Experimental vibration testing requires the practitioner to understand the basics of testing hardware and digital signal processing.
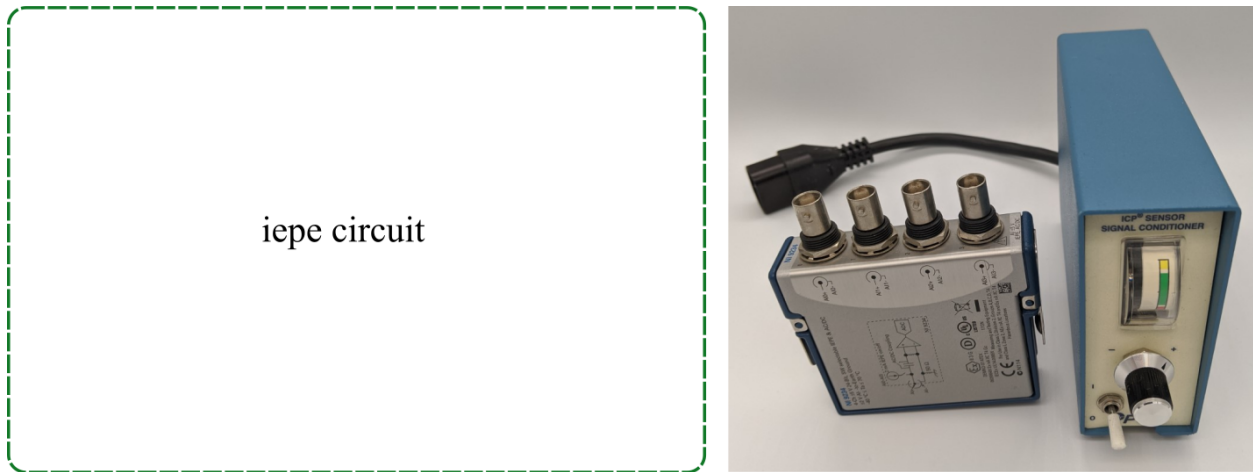
8.1 Hardware for vibration testing

Figure 1: Integrated Electronics Piezo-Electric (IEPE)-based measurement system showing the: (a) IEPE accelerometer; and (b) IEPE data acquisition systems in various form factors.

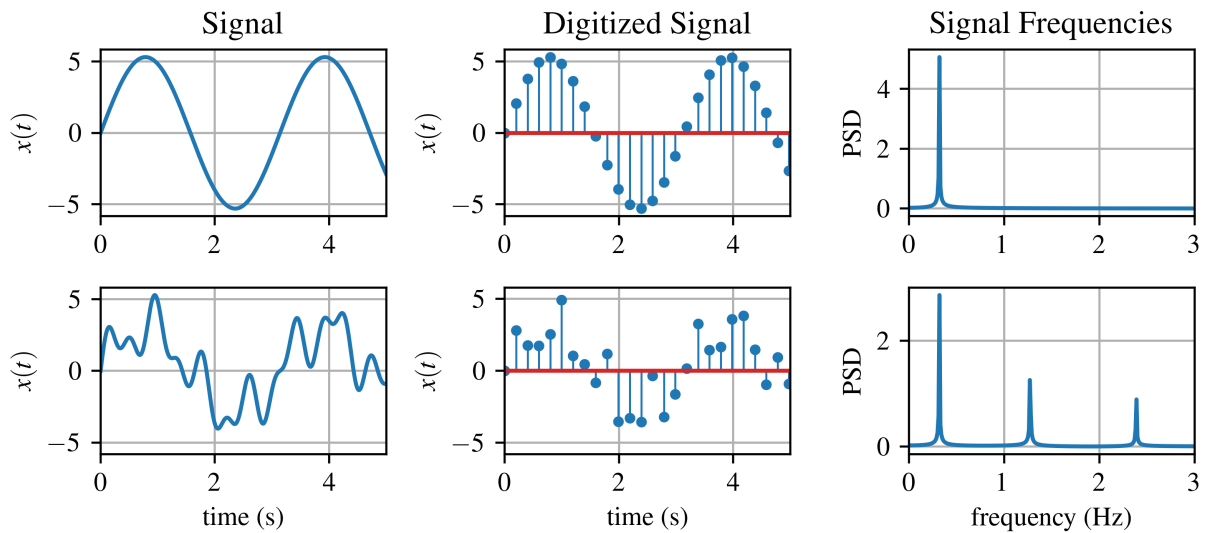## 8.2 Digital Signal Processing

Figure 2: Digitization of two continuous time-series signals sampled at 5 S/s.

The Nyquist?Shannon sampling theorem is a theorem in the field of signal processing that defines the sample rate that permits a discrete sequence of samples (i.e. discrete-time) to sample a continuous-time signal of a finite bandwidth.
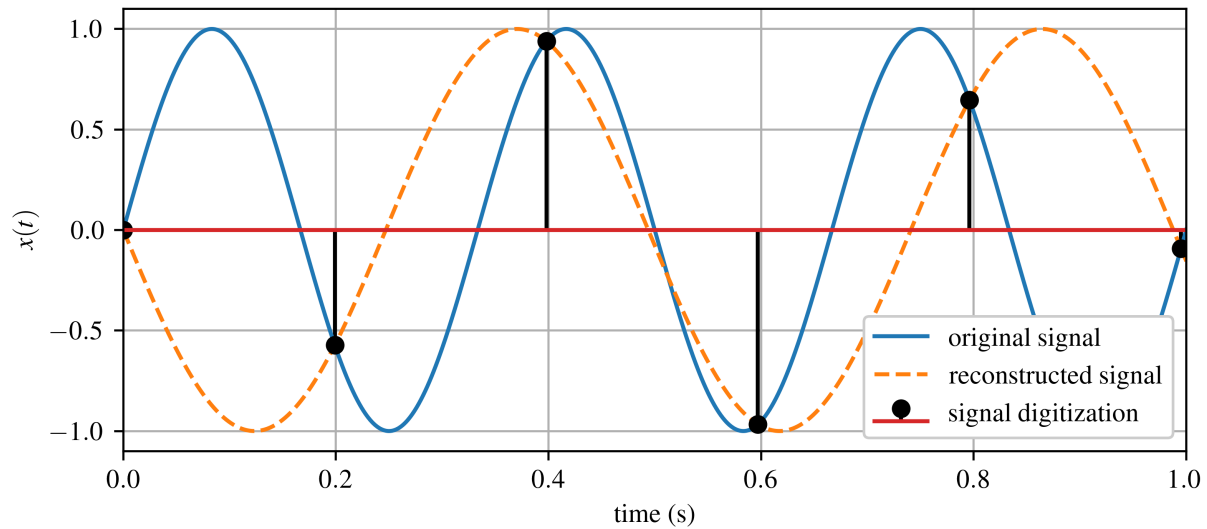

Figure 3: Aliasing of a 3 Hz signal that is sampled at 5 S/s.

In signal processing, aliasing is an effect that causes different signals to become indistinguishable from each other. In this way, the signals become an aliases of one another when sampled. Aliasing also accounts for the development of distortion or artifact in a reconstructed signal when compared to the original continuous signal.
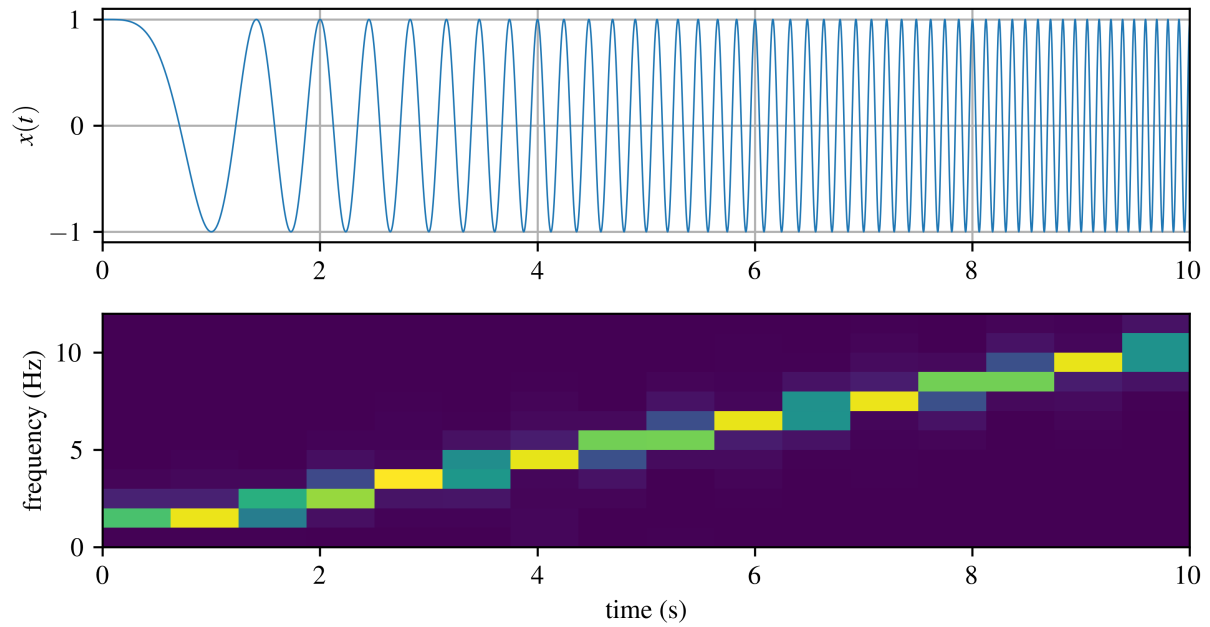
Figure 4: Spectrogram of a 0-10 Hz chirp signal.

Some of the key parameters in a spectrogram include:

- window

- segment length

- overlap