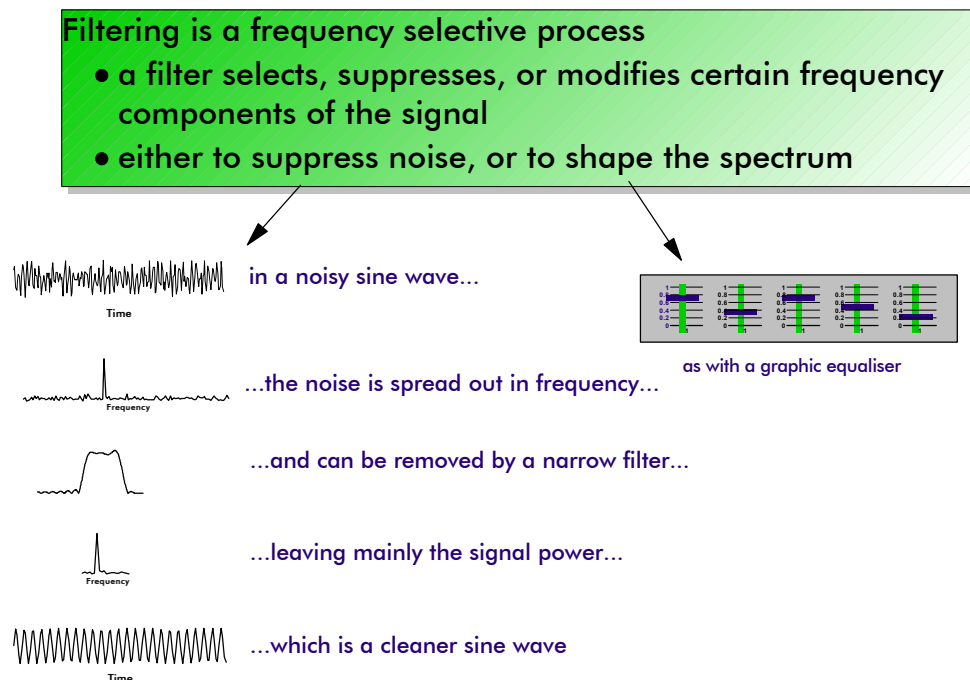


# Filtering as a frequency operation

**Filtering** is a process of selecting, or suppressing, certain frequency components of a signal.



Filtering is often, though not always, done to suppress noise. It depends on the signal's **frequency spectrum** being different from that of the noise. The diagram shows how a noisy sine wave viewed as a time domain signal cannot be clearly distinguished from the noise. But when viewed as a **frequency spectrum**, the sine wave shows as a single clear peak while the noise power is spread over a broad **frequency spectrum**. The noisy sine wave may be 'cleaned up' by selecting only a range of frequencies that include signal frequency components but exclude much of the noise.

Filters may also be used to shape the **frequency spectrum** of a signal: for instance to correct for the characteristics of a transmission circuit such as a telephone line, or to apply more bass to an audio recording.

Digital filters and coffee filters have some similarities beyond just the same name. A coffee filter allows small particles to pass while trapping the larger grains. A digital filter does a similar thing, but with more subtlety. The digital filter allows to pass certain frequency components of the signal: in this it is similar to the coffee filter, with frequency standing in for particle size. But the digital filter can be more subtle than simply trapping or allowing through: it can attenuate, or suppress, each frequency components by a desired amount. This allows a digital filter to shape the **frequency spectrum** of the signal.