It could well be that computing this sum is easier than integrating the signal's square. Furthermore, the contribution of each term in the Fourier series toward representing the signal can be measured by its contribution to the signal's average power. Thus, the power contained in a signal at its ***k***th harmonic is



. The **power spectrum**, ***Ps*** (***k***), such as shown in[Figure 4.4](#_bookmark263), plots each harmonic's contribution to the total power.

In high-end audio, deviation of a sine wave from the ideal is measured by the **total harmonic distortion**, which equals the total power in the harmonics higher than the first compared to power in the fundamental. Find an expression for the total harmonic distortion for any periodic signal. Is this calculation most easily performed in the time or frequency domain?

**Exercise 4.4.2**

### Fourier Series Approximation of Signals

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It is interesting to consider the sequence of signals that we obtain as we incorporate more terms into the Fourier series approximation of the half-wave rectifed sine wave (Example 4.2). Defne ***sK*** (***t***) to be the signal containing ***K*** +1 Fourier terms.



[Figure 4.5](#_bookmark266)shows how this sequence of signals portrays the signal more accurately as more terms are added.