

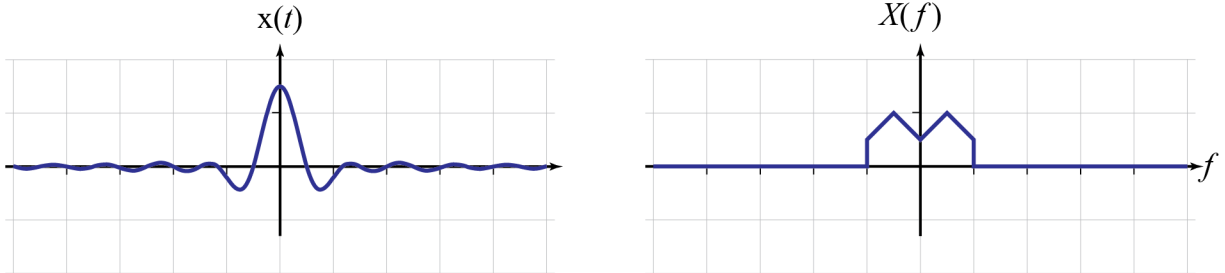
TOOL: The spectrum described below is bandwidth-limited and has relatively simple formulas in both the time and frequency domains. The spectrum has the shape of a crown.

The spectrum is a rectangle function with two half-width triangle functions on top of it.

$$\begin{aligned} X(f) &= \frac{1}{2} \text{rect} \left(\frac{f}{2} \right) + \Lambda(2f) * \frac{1}{2} \left[\delta \left(f + \frac{1}{2} \right) + \delta \left(f - \frac{1}{2} \right) \right] \\ &= \frac{1}{2} \text{rect} \left(\frac{f}{2} \right) + \frac{1}{2} \Lambda \left(2 \left[f + \frac{1}{2} \right] \right) + \frac{1}{2} \Lambda \left(2 \left[f - \frac{1}{2} \right] \right) \end{aligned}$$

In the time domain, the function is a sum involving $\text{sinc}(\cdot)$ and $\text{sinc}^2(\cdot)$ functions.

$$x(t) = \text{sinc}(2t) + \frac{1}{2} \text{sinc}^2 \left(\frac{t}{2} \right) \cos(\pi t).$$



The spectrum may also be written in a piecewise form:

$$X(f) = \begin{cases} \frac{3}{2} \left(f + \frac{3}{2} \right) & -1 \leq f \leq -\frac{1}{2} \\ -\frac{3}{2} \left(f - \frac{1}{2} \right) & -\frac{1}{2} \leq f \leq 0 \\ \frac{3}{2} \left(f + \frac{1}{2} \right) & 0 \leq f \leq \frac{1}{2} \\ -\frac{3}{2} \left(f - \frac{3}{2} \right) & \frac{1}{2} \leq f \leq 1 \\ 0 & \text{otherwise} \end{cases}.$$