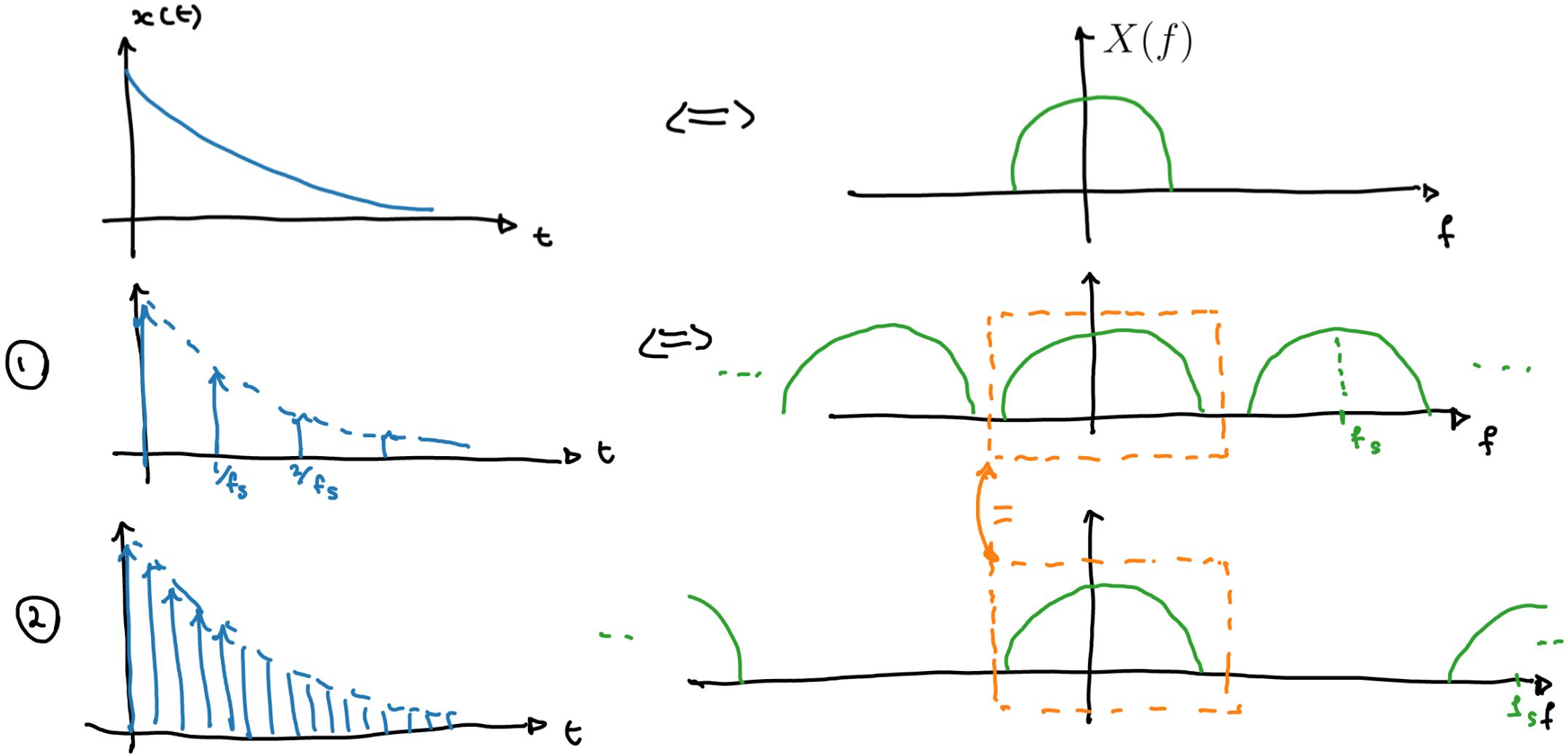
Zero padding

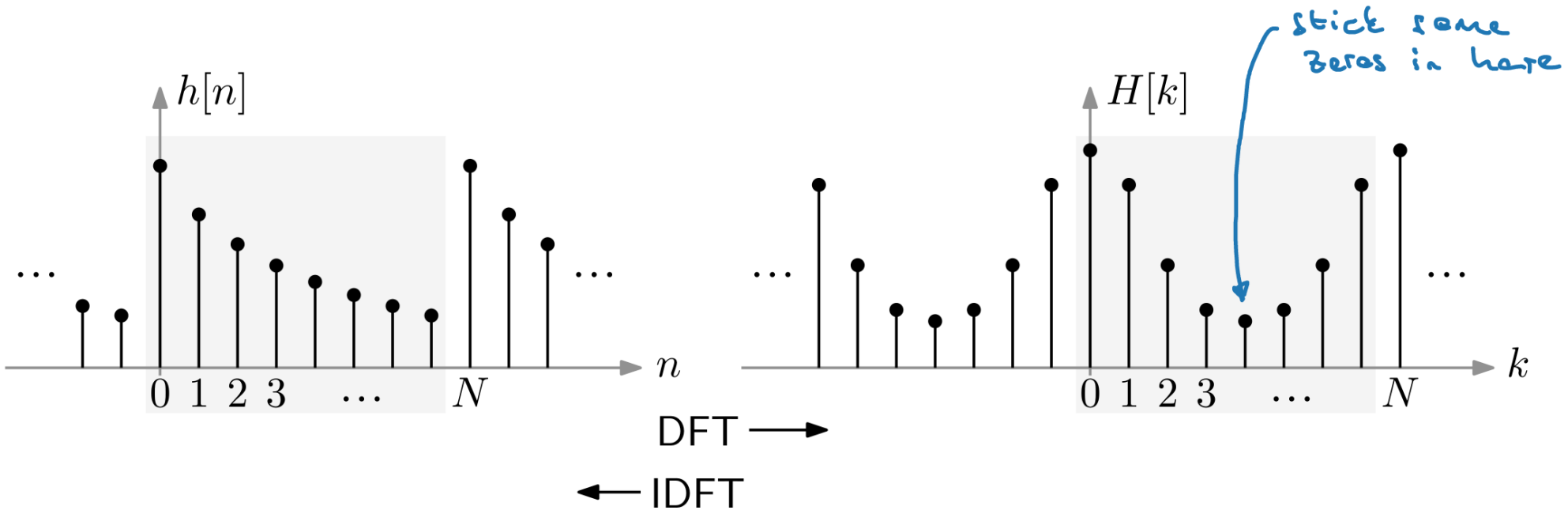
Increasing resolution in time and frequency

Herman Kamper

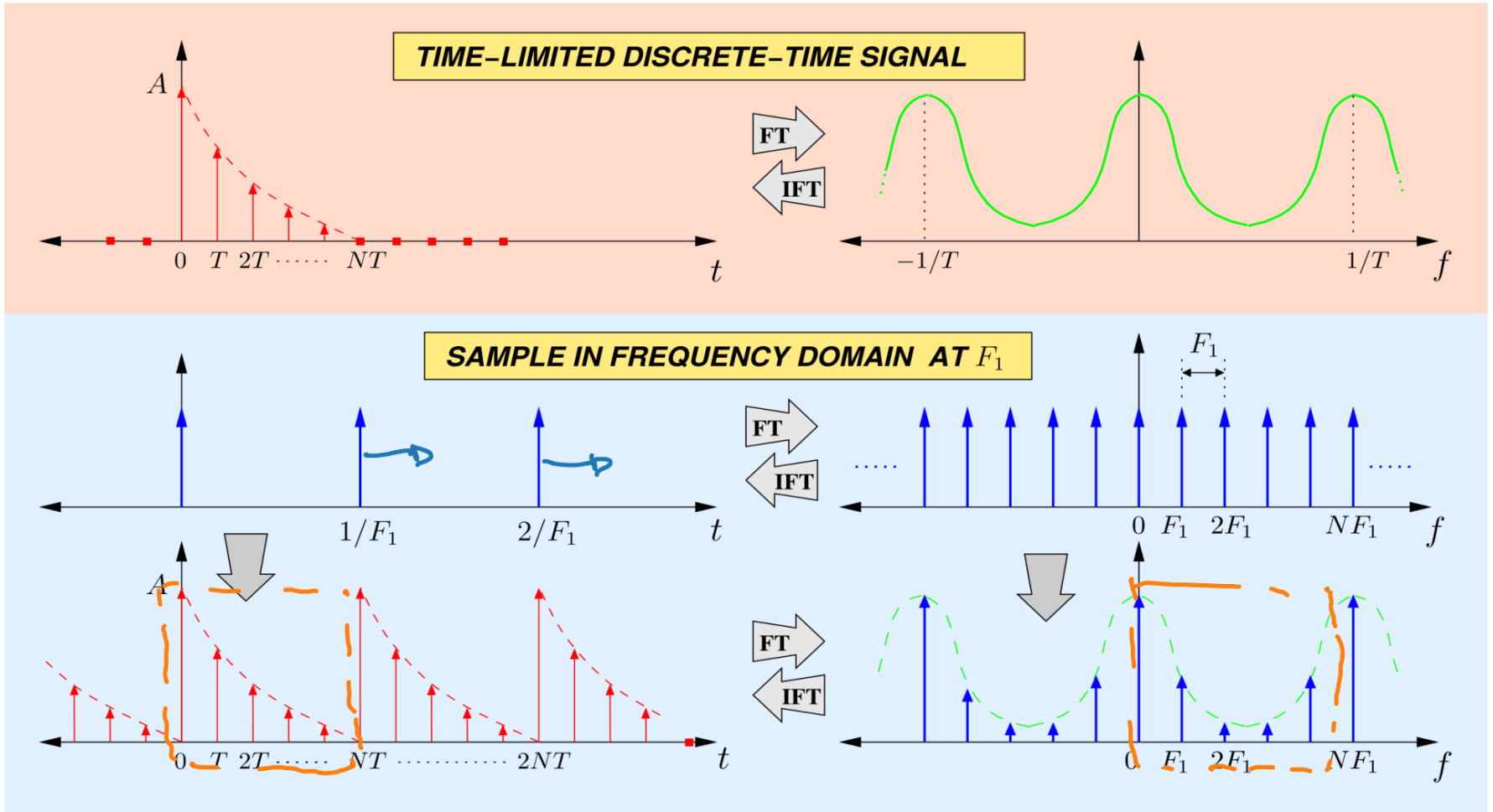
Increased time-domain resolution



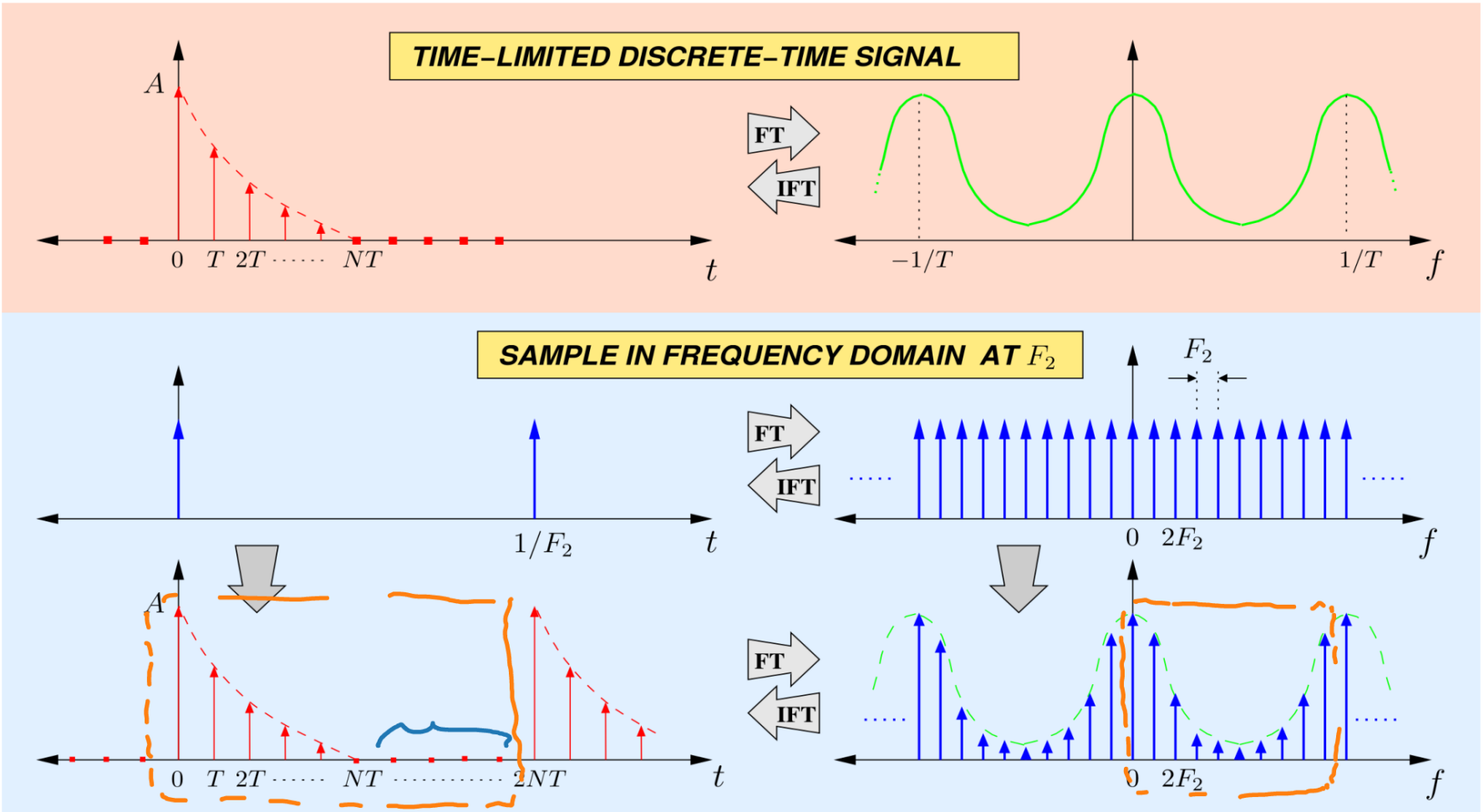
Where do the zeros go?



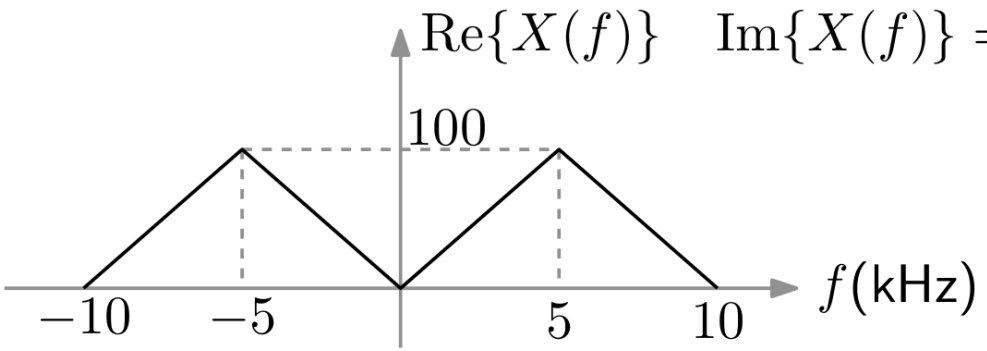
Increased frequency-domain resolution



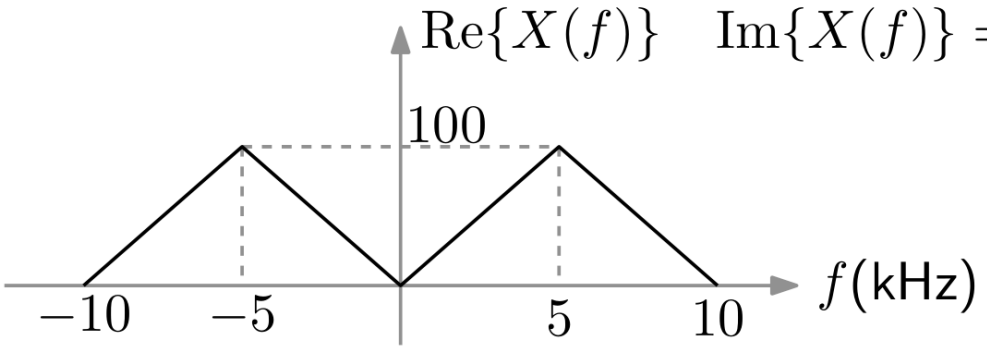
Increased frequency-domain resolution



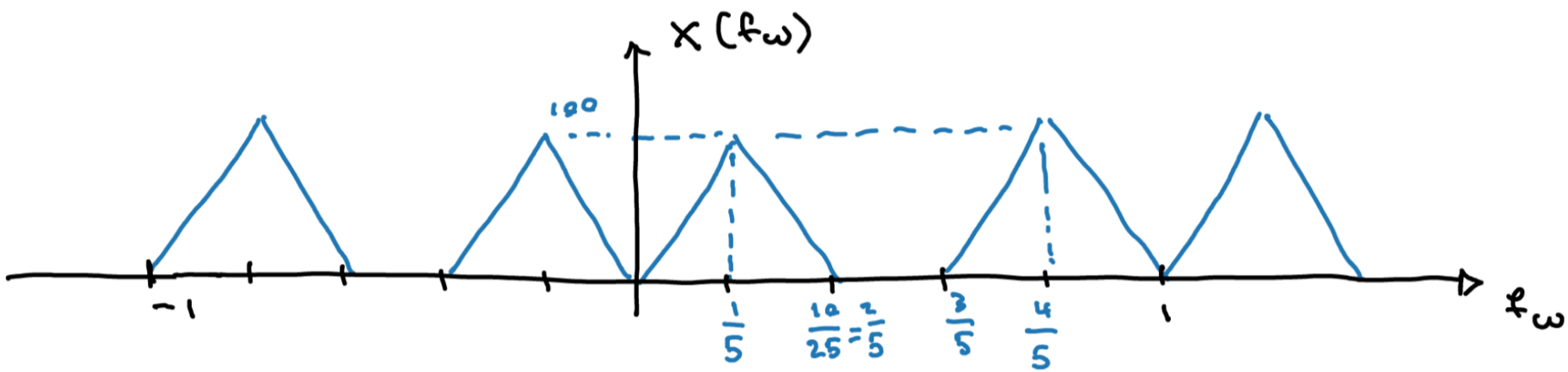
Example

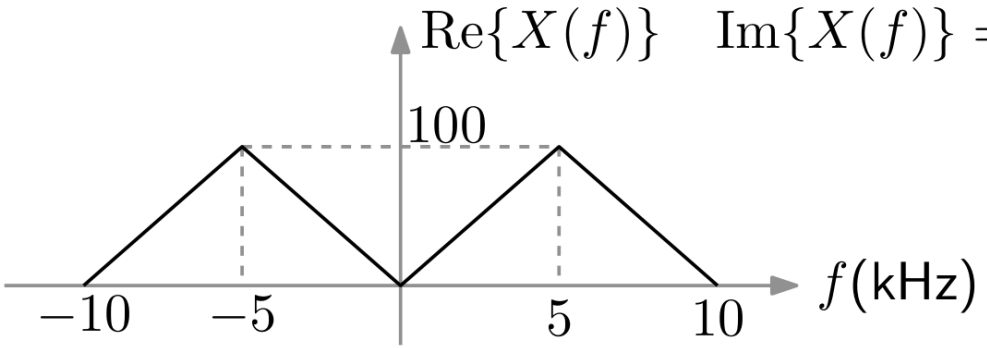


- Is $x(t)$ periodic or aperiodic? Answer: Aperiodic
- Is $x(t)$ even, odd, or neither? Answer: Real and even
- What is the minimum sampling frequency required to avoid aliasing when sampling this signal? Answer: 20 kHz



A discrete-time signal $x[n]$ is obtained by sampling $x(t)$ at a sampling frequency of $f_s = 25$ kHz. Sketch the spectrum $X(f_\omega)$ of the sampled signal $x[n]$.





The signal $x(t)$ is now sampled at $f_s = 15$ kHz. Sketch the spectrum $X(f_\omega)$ of the sampled signal $x[n]$.