

Radio Navigation and Radar

4. Exercise

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1. Problem

Determine the spectrum

$$\underline{S}(\omega) = \int_{-\infty}^{+\infty} \underline{s}(t) e^{-j\omega t} dt$$

of the linearly frequency modulated pulse

$$\underline{s}(t) = \text{rect}\left(\frac{t}{T}\right) e^{j\frac{1}{2}kt^2}$$

You may use the Fresnel integrals

$$C(z) = \int_0^z \cos\left(\frac{\pi x^2}{2}\right) dx$$

$$S(z) = \int_0^z \sin\left(\frac{\pi x^2}{2}\right) dx$$

to represent your result.

2. Problem

In the following an unmodulated train of pulses

$$\underline{s}(t) = \sum_{k=-\infty}^{+\infty} \underline{s}_P(t - kT)$$

is considered.

- a) Discuss the range ambiguity based on typical properties of trains of pulses!
- b) Determine the spectrum

$$\underline{S}(\omega) = \int_{-\infty}^{+\infty} \underline{s}(t) e^{-j\omega t} dt$$

of the unmodulated train of pulses as a function of the spectrum

$$\underline{S}_P(\omega) = \int_{-\infty}^{+\infty} \underline{s}_P(t) e^{j\omega t} dt$$

of the basis pulse and the period T !

- c) Discuss the velocity ambiguity based on typical properties of spectra of trains of pulses!