Digital Communications and Laboratory
Second Homework

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Problem 1

Problem 2

The Doppler spectrum $\mathcal{D}(\lambda)$ represents the power of the Doppler shift for different frequencies λ.
This quantity is defined as the Fourier transform of the autocorrelation function of the impulse response of the channel.
The maximum frequency f_d of the Doppler spectrum support is called *Doppler spread* of the channel and it is a measure of the fading rate. A model which is widely used is the so called *classical Doppler spectrum*:

$$\mathcal{D}(f) = \begin{cases} \frac{1}{\pi f_d} \frac{1}{\sqrt{1-(f-f_d)^2}} & |f| \leq f_d \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

The Doppler spectrum can be implemented using an IIR filter h_{ds} such that $|\mathcal{H}_{ds}(f)|^2 = \mathcal{D}(f)$.

Bibliography

[1] Nevio Benvenuto, Giovanni Cherubini, *Algorithms for Communication Systems and their Applications*. Wiley, 2002.