Structured Electronic Design

Butterworth
Maximally Flat Magnitude
Frequency Responses

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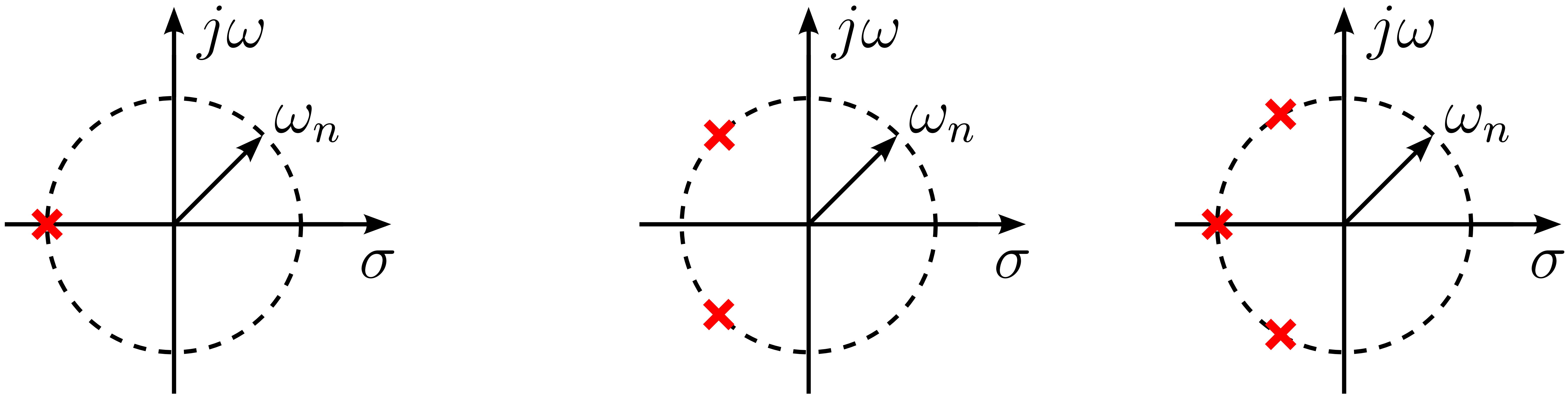
All-pole Butterworth (MFM) reponses



$$p_1 = -\omega_n$$

$$p_{1,2} = -\tfrac{1}{2}\sqrt{2}\omega_n(1 \pm j)$$

$$p_1 = -\omega_n$$
$$p_{2,3} = -\tfrac{1}{2}\omega_n \pm j\tfrac{1}{2}\sqrt{3}\omega_n$$

$$H_1(s) = \frac{1}{1+s\frac{1}{\omega_n}}$$

$$H_2(s) = \frac{1}{1+s\frac{\sqrt{2}}{\omega_n}+s^2\frac{1}{\omega_n^2}}$$

$$H_3(s) = \frac{1}{1+s\frac{2}{\omega_n}+s^2\frac{2}{\omega_n^2}+s^3\frac{1}{\omega_n^3}}$$

Denominatior coefficient of highest order of s determines the bandwidth

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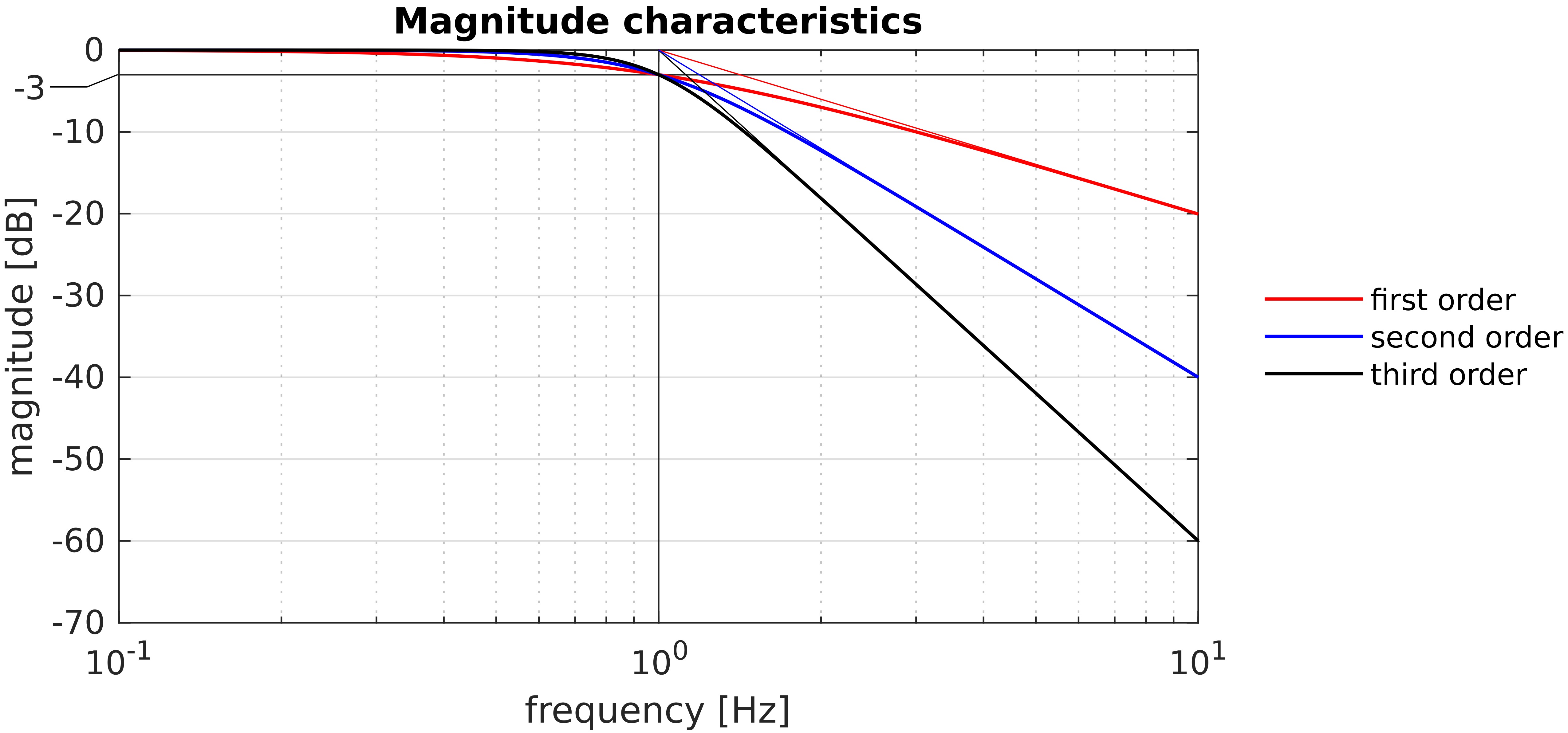

$$H_1(s) = \frac{1}{1+s\,\frac{1}{\omega_n}} \qquad H_2(s) = \frac{1}{1+s\,\frac{\sqrt{2}}{\omega_n}+s^2\,\frac{1}{\omega_n^2}} \qquad H_3(s) = \frac{1}{1+s\,\frac{2}{\omega_n}+s^2\,\frac{2}{\omega_n^2}+s^3\,\frac{1}{\omega_n^3}}$$

Butterworth or MFM: -3dB frequency at interserction of asymptotes: $\omega_{-3\mathrm{dB}} = \omega_n$

