Structured Electronic Design

Dominant and non-dominant poles in feedback systems

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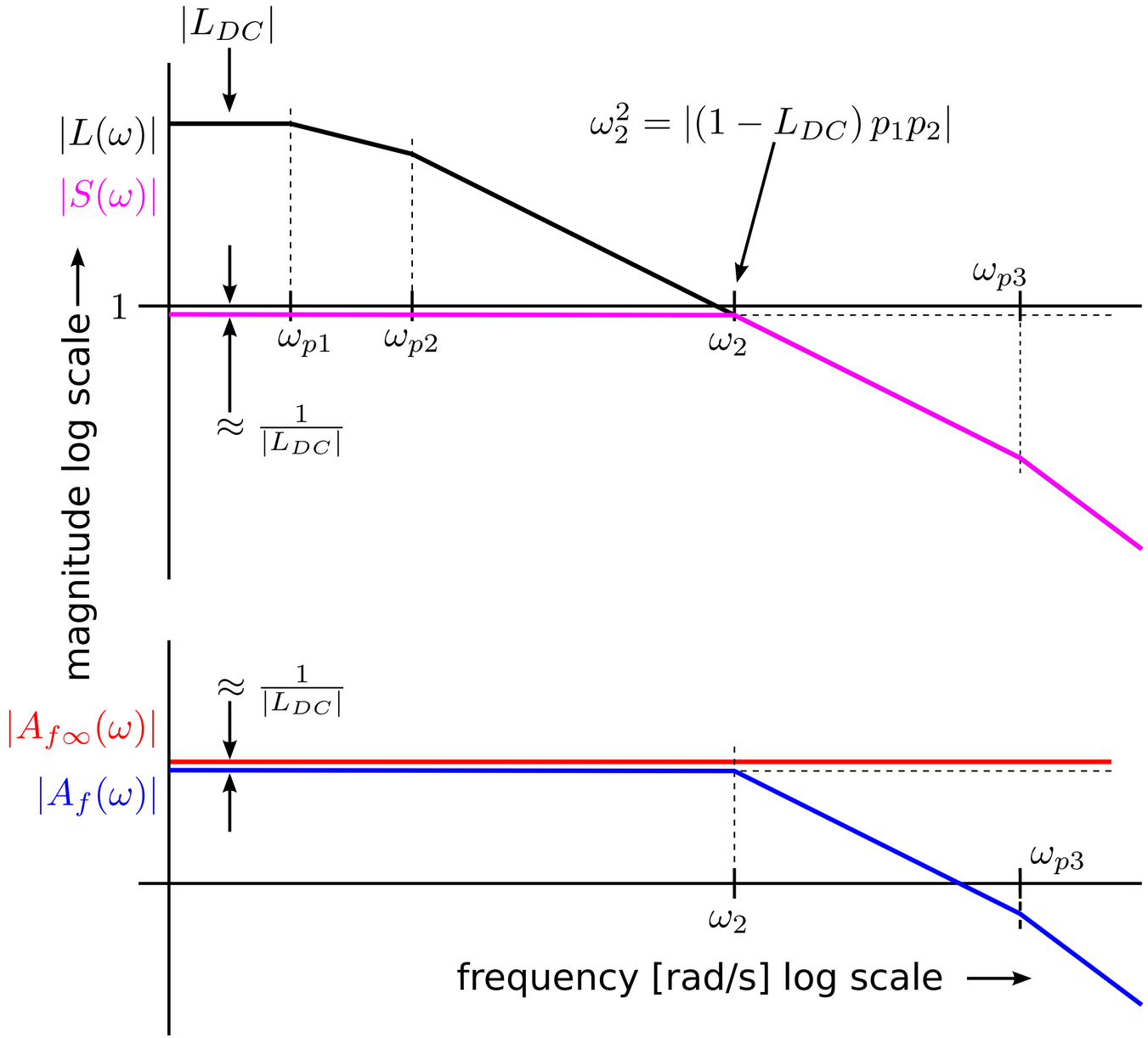
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

$|L(\omega)|$

$|S(\omega)|$ $\omega_2 < \omega_3 < \omega_1$

$|A_{f\infty}(\omega)|$

$|A_f(\omega)|$

Dominant poles:
p_1, p_2

Non-dominant pole:
p_3

Pole non-dominant if magnitude of loop gain at pole frequency smaller than unity

Procedure for determination of the dominant poles

1. Rank the poles of the loop gain in ascending order:

$$|p_1| < |p_2| < |p_3|$$

2. Calculate the -3dB low-pass cut-off frequency for increasing order:

$$\omega_1 = |(1 - L_{DC})\, p_1|\,,$$
$$\omega_2 = \sqrt{|(1 - L_{DC})\, p_1 p_2|},$$
$$\omega_3 = \sqrt[3]{|(1 - L_{DC})\, p_1 p_2 p_3|}.$$

3. Stop this procedure if cut-off frequency increases

4. The order n is the number for which this cut-off frequency has the smallest value