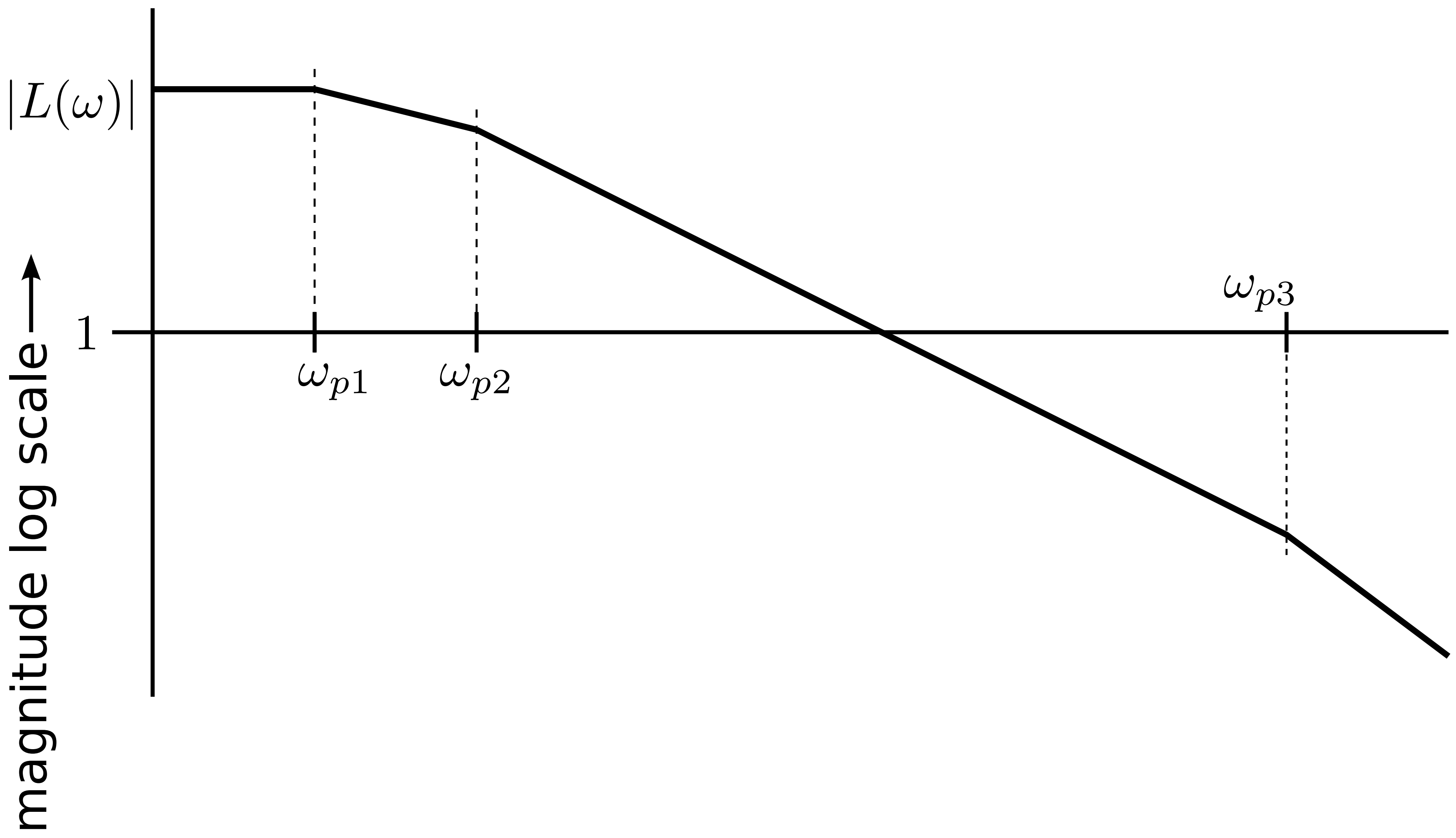
Structured Electronic Design

Dominant and non-dominant poles in feedback systems

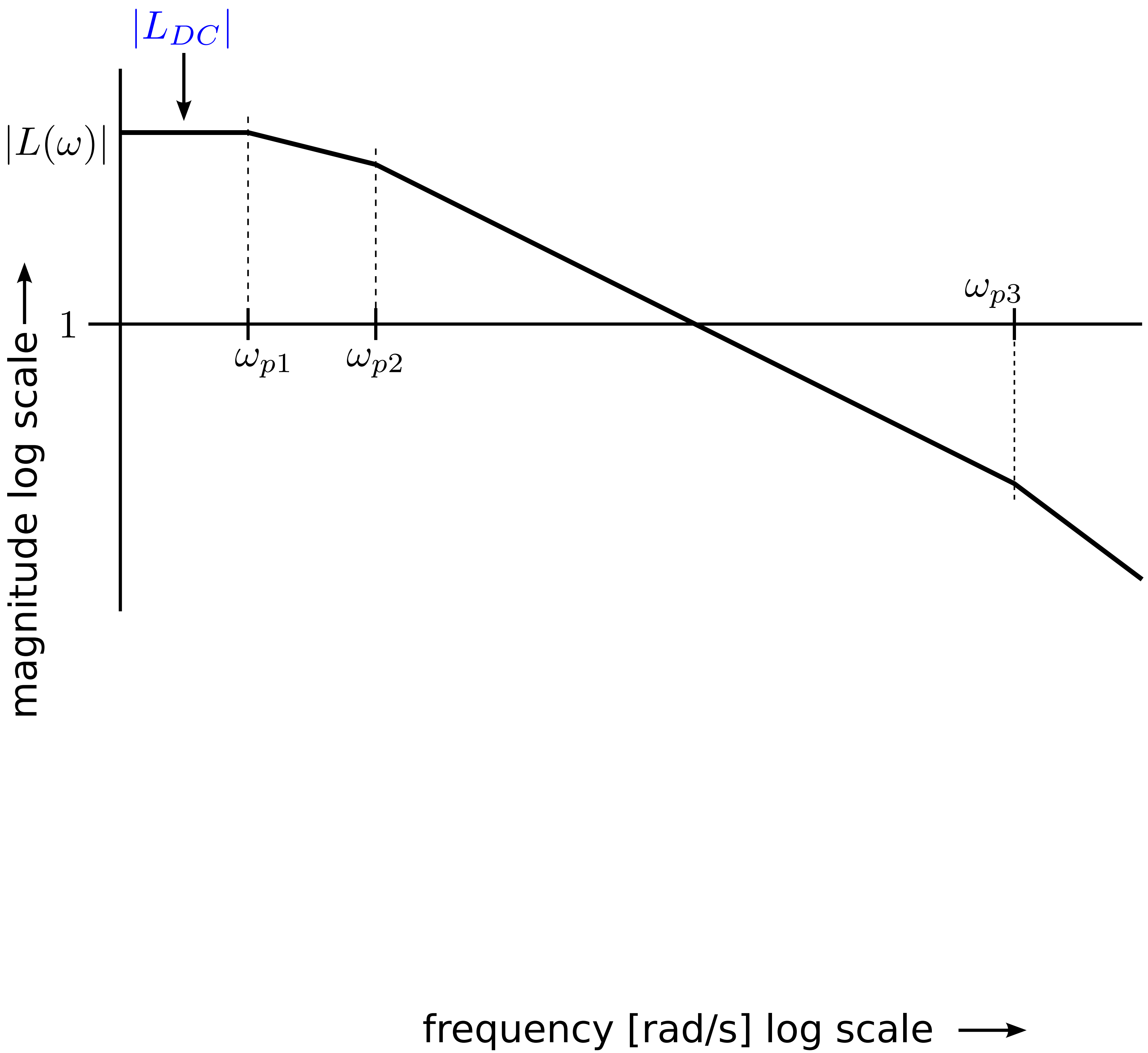
Anton J.M. Montagne

Dominant and non-dominant poles



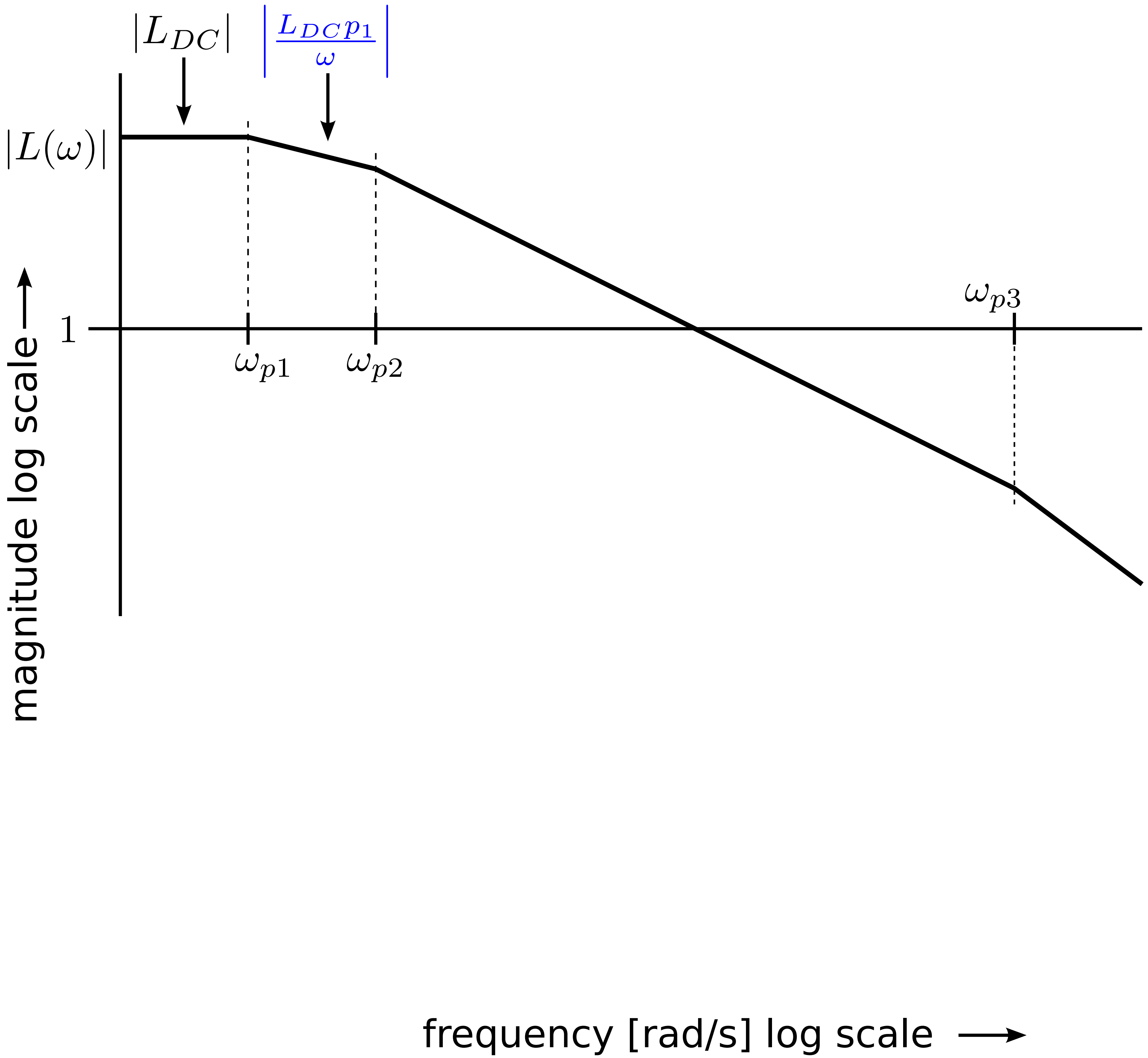
Magnitude plot with three separated negative real poles

Dominant and non-dominant poles



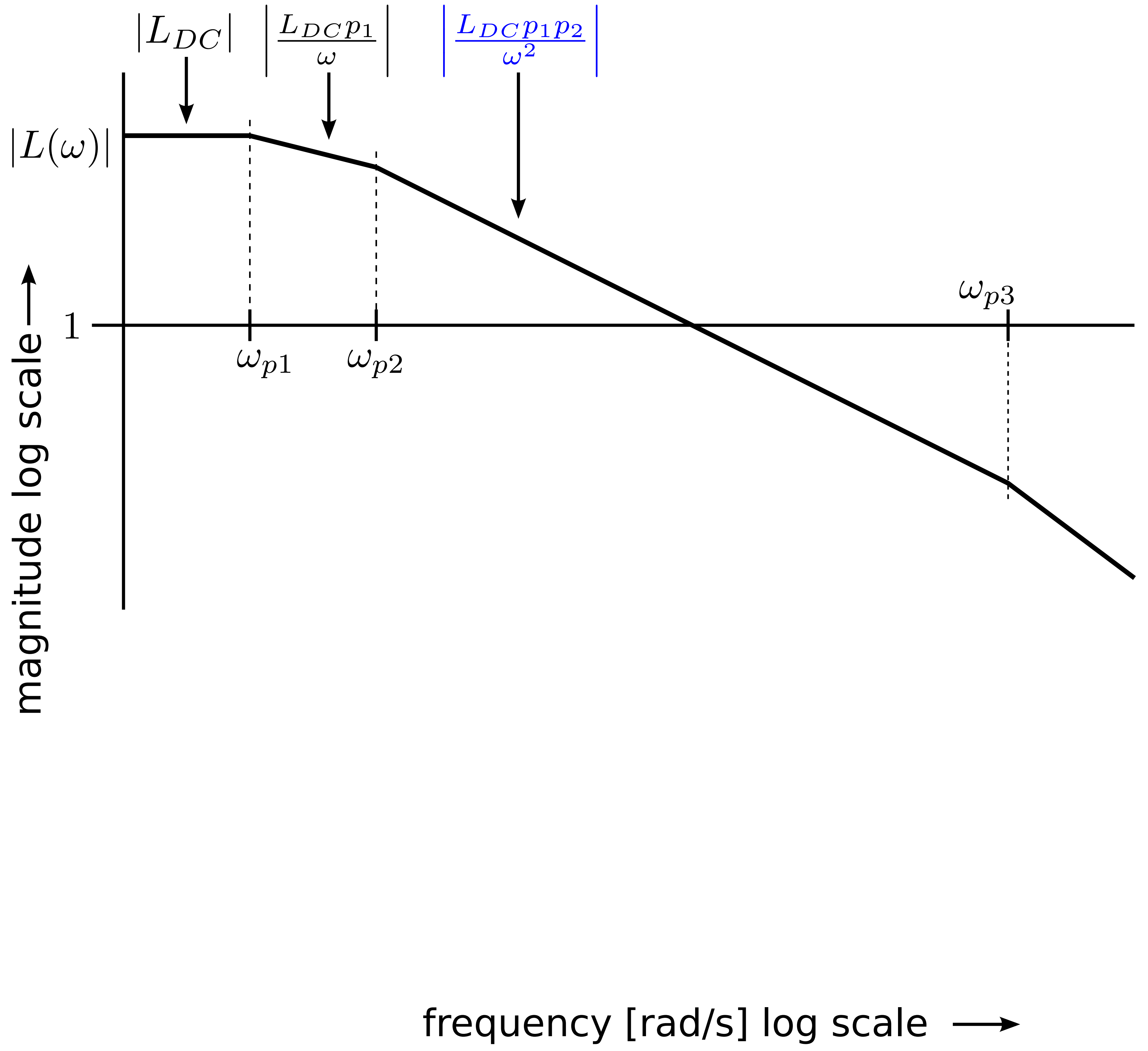
Magnitude plot with three separated negative real poles

Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

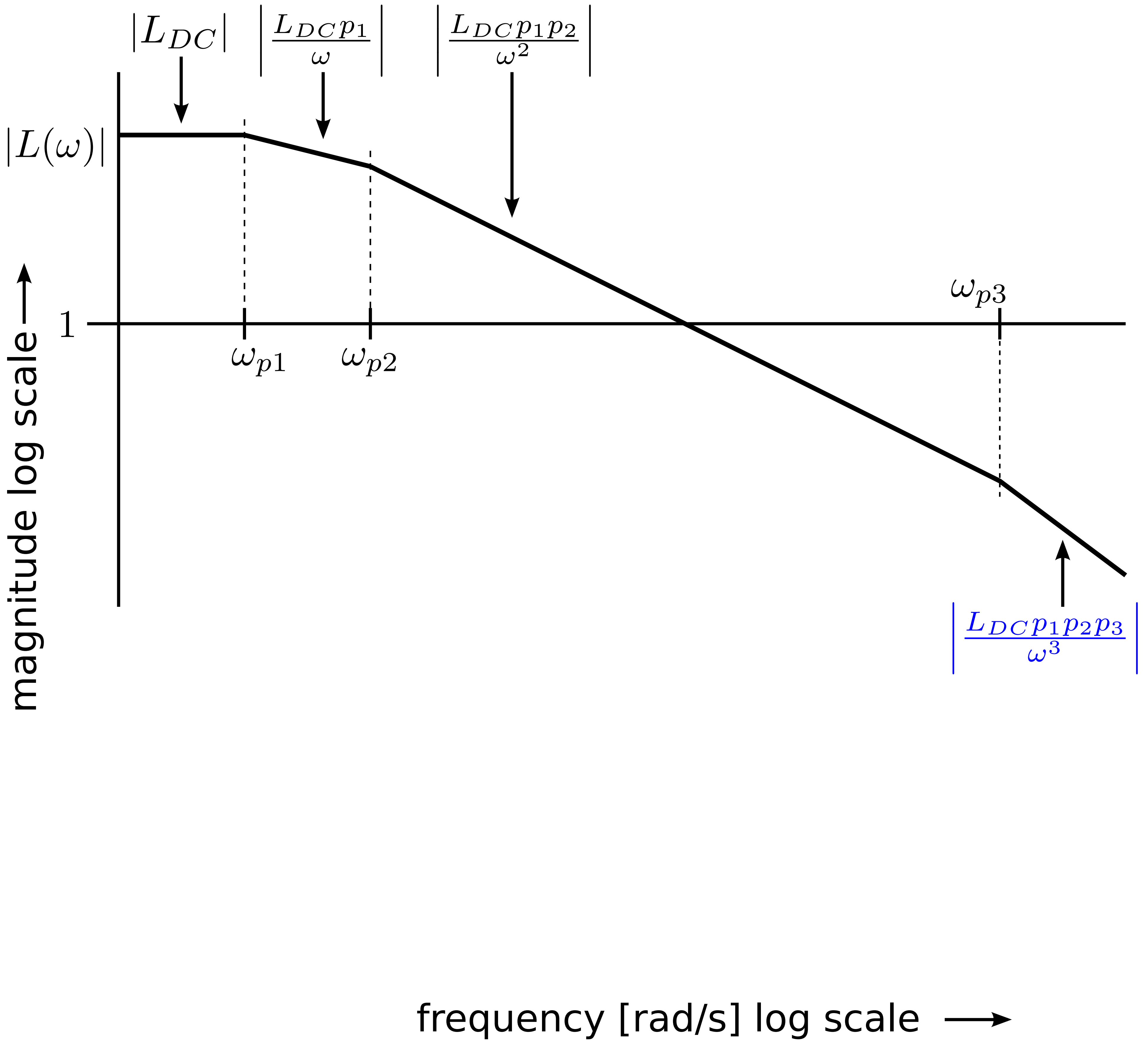
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

— $|L(\omega)|$

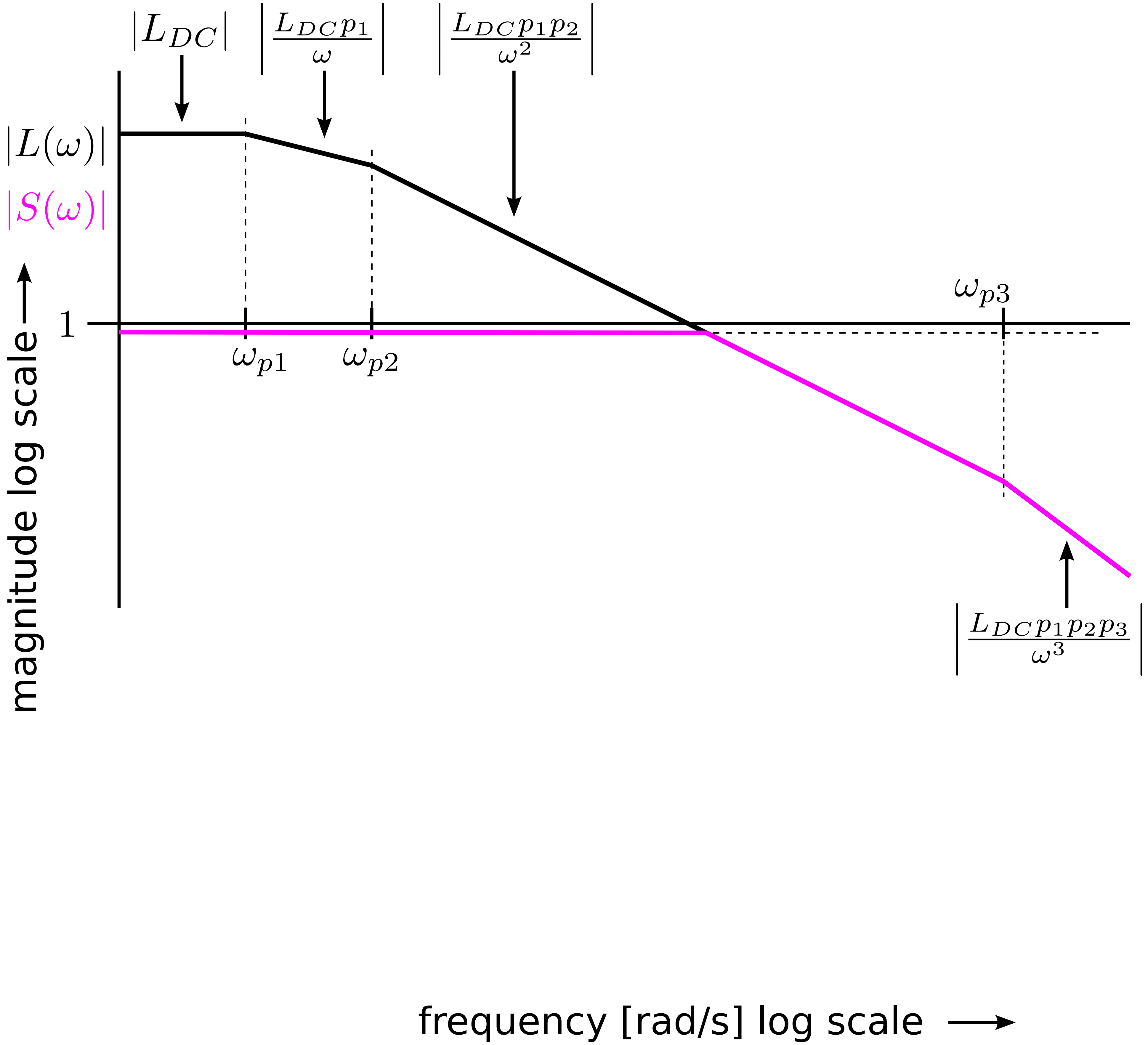
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

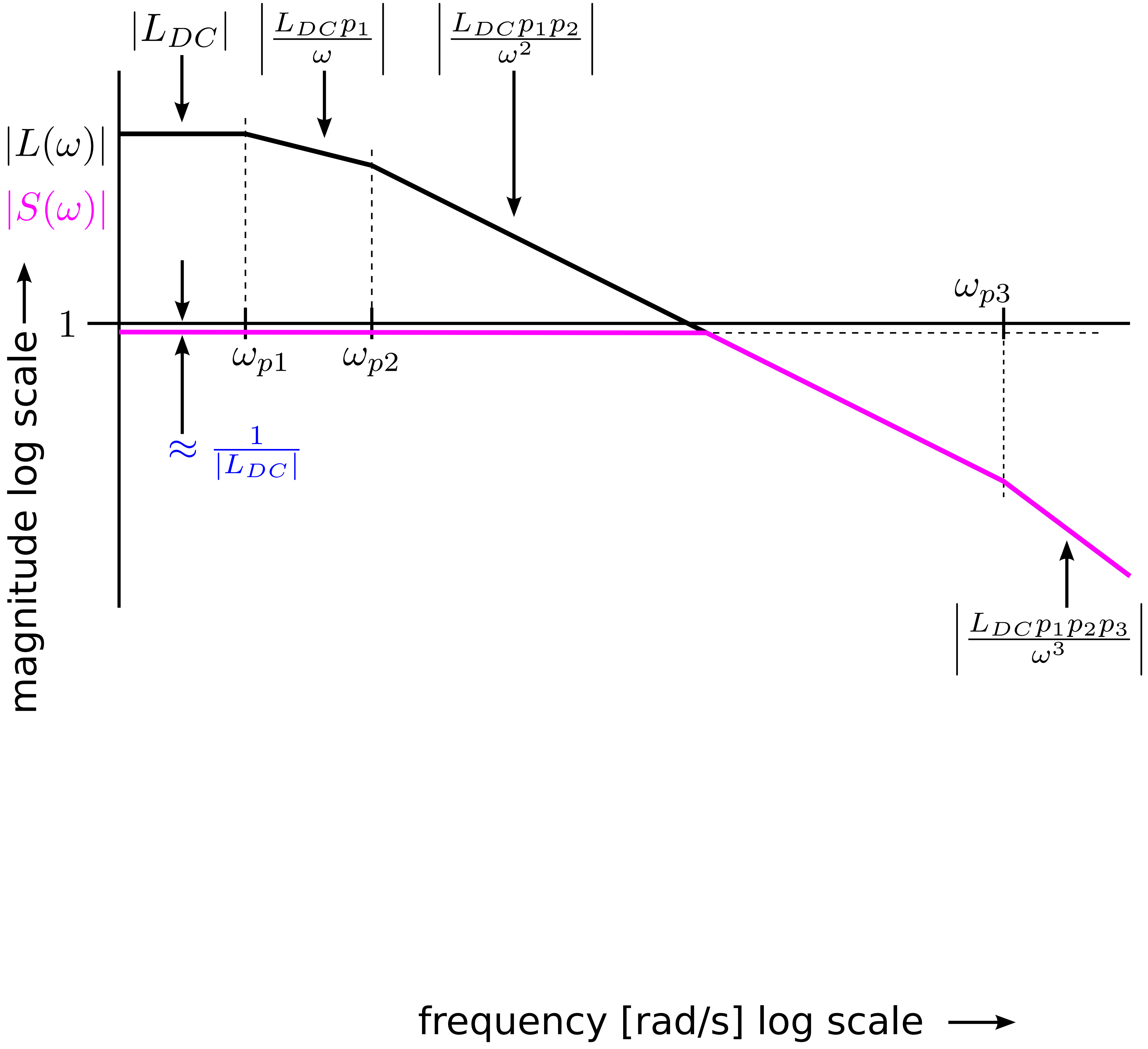
— $|L(\omega)|$

Dominant and non-dominant poles

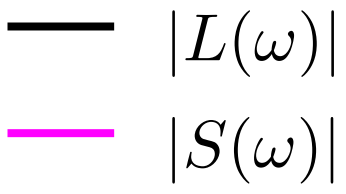


Magnitude plot with three separated negative real poles

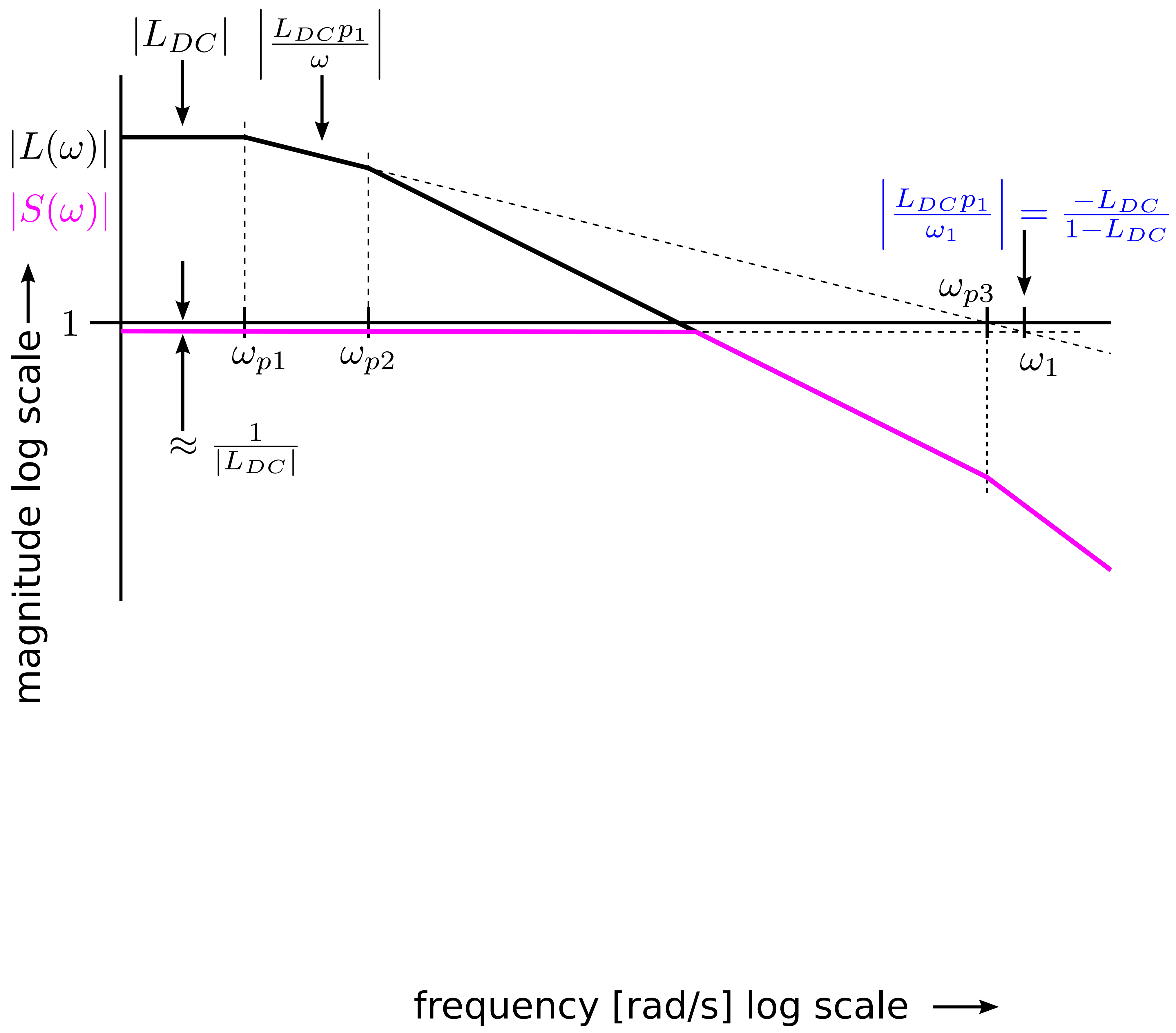
Dominant and non-dominant poles



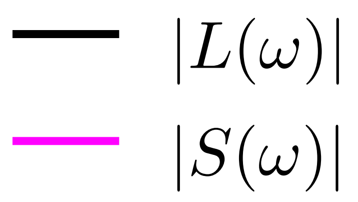
Magnitude plot with three separated negative real poles



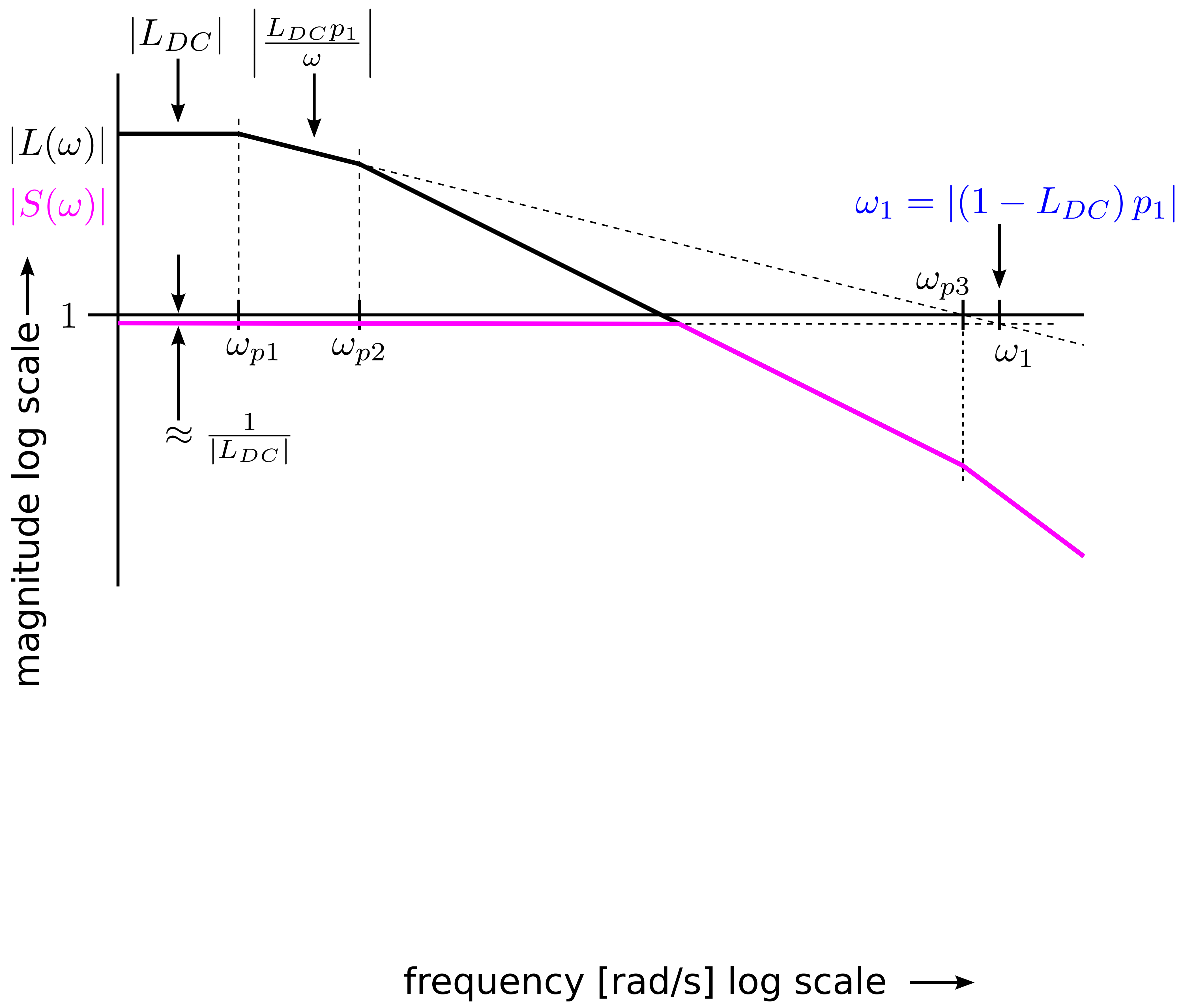
Dominant and non-dominant poles



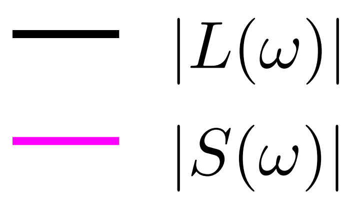
Magnitude plot with three separated negative real poles



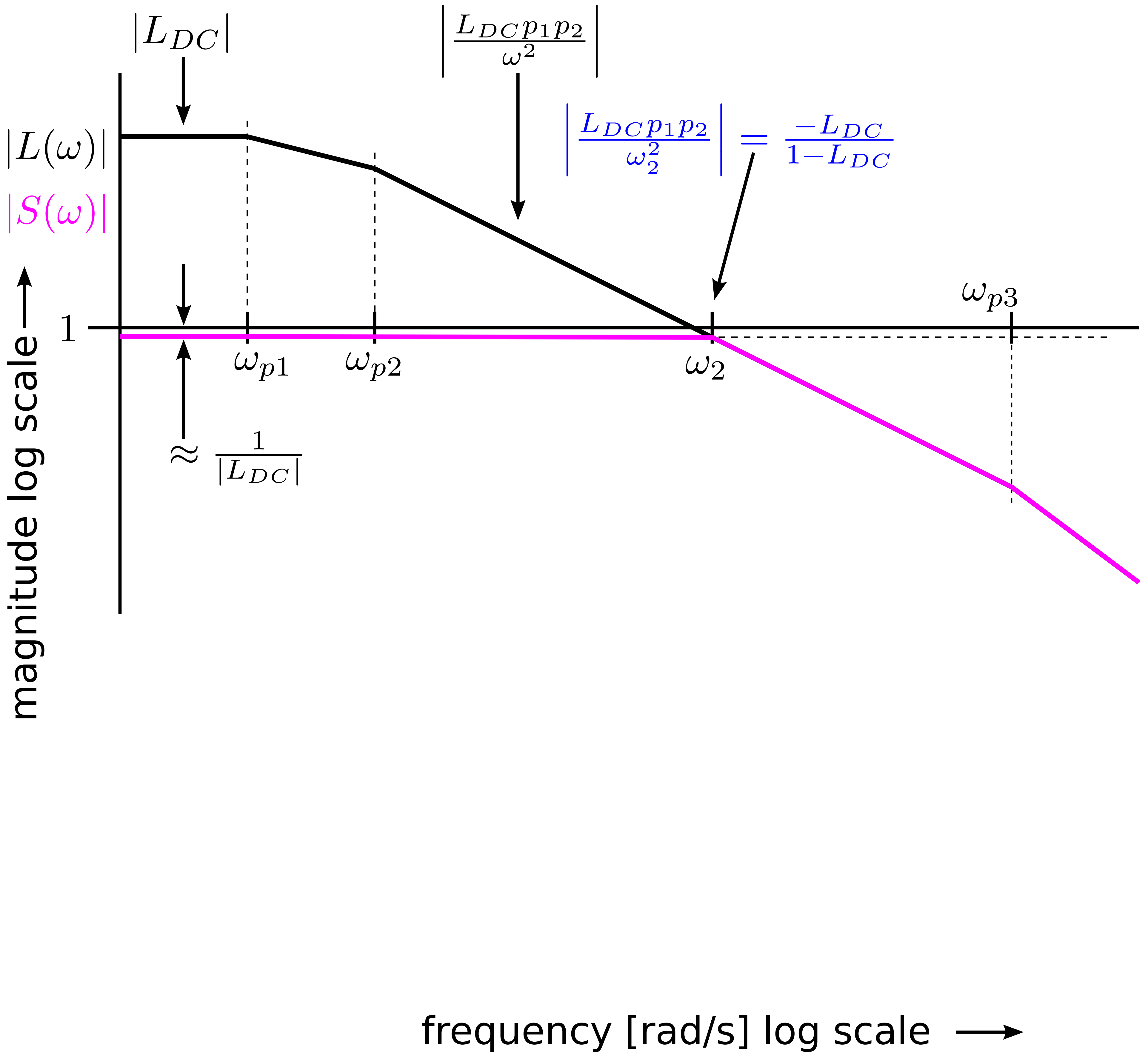
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

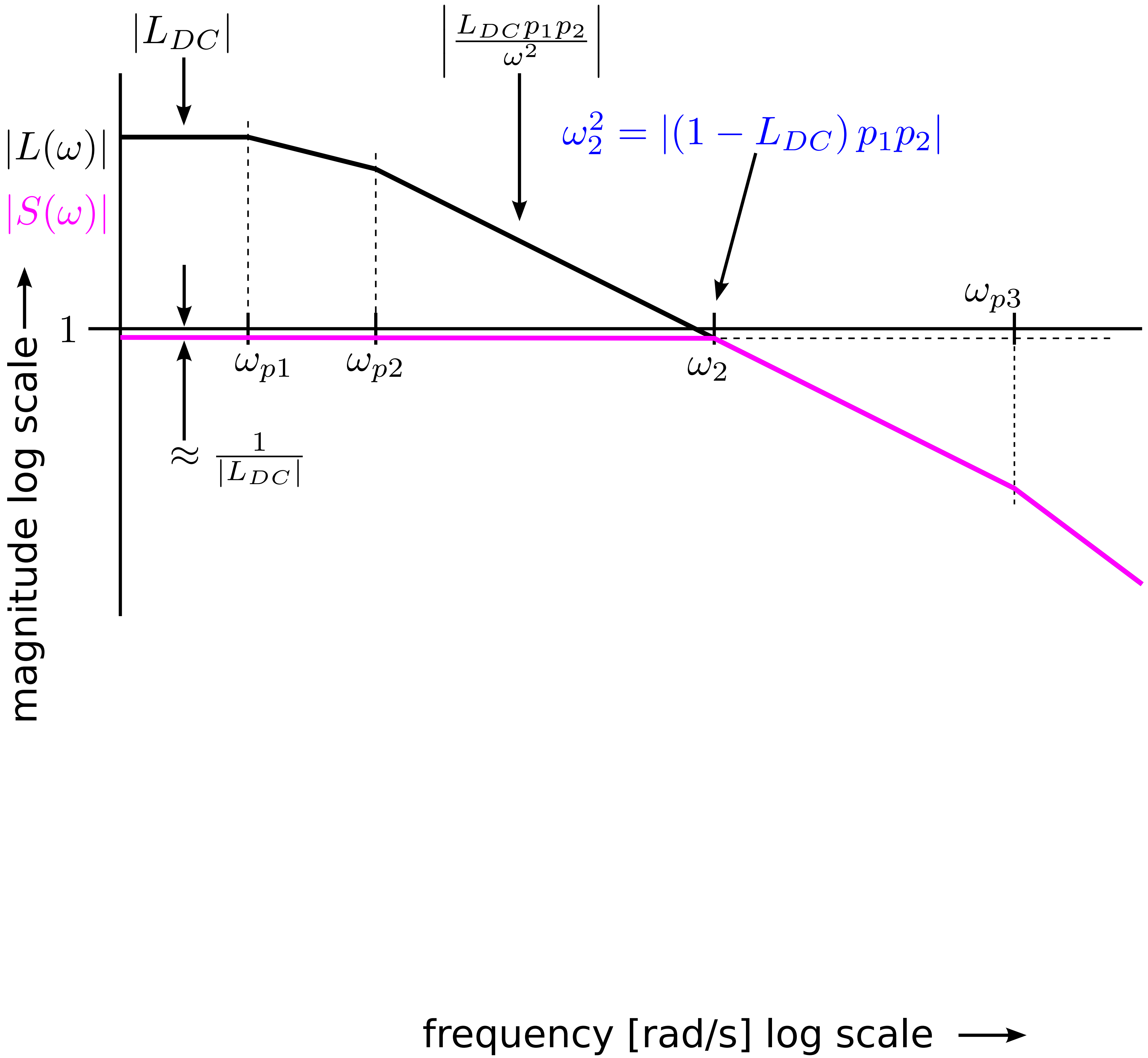


Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

Dominant and non-dominant poles

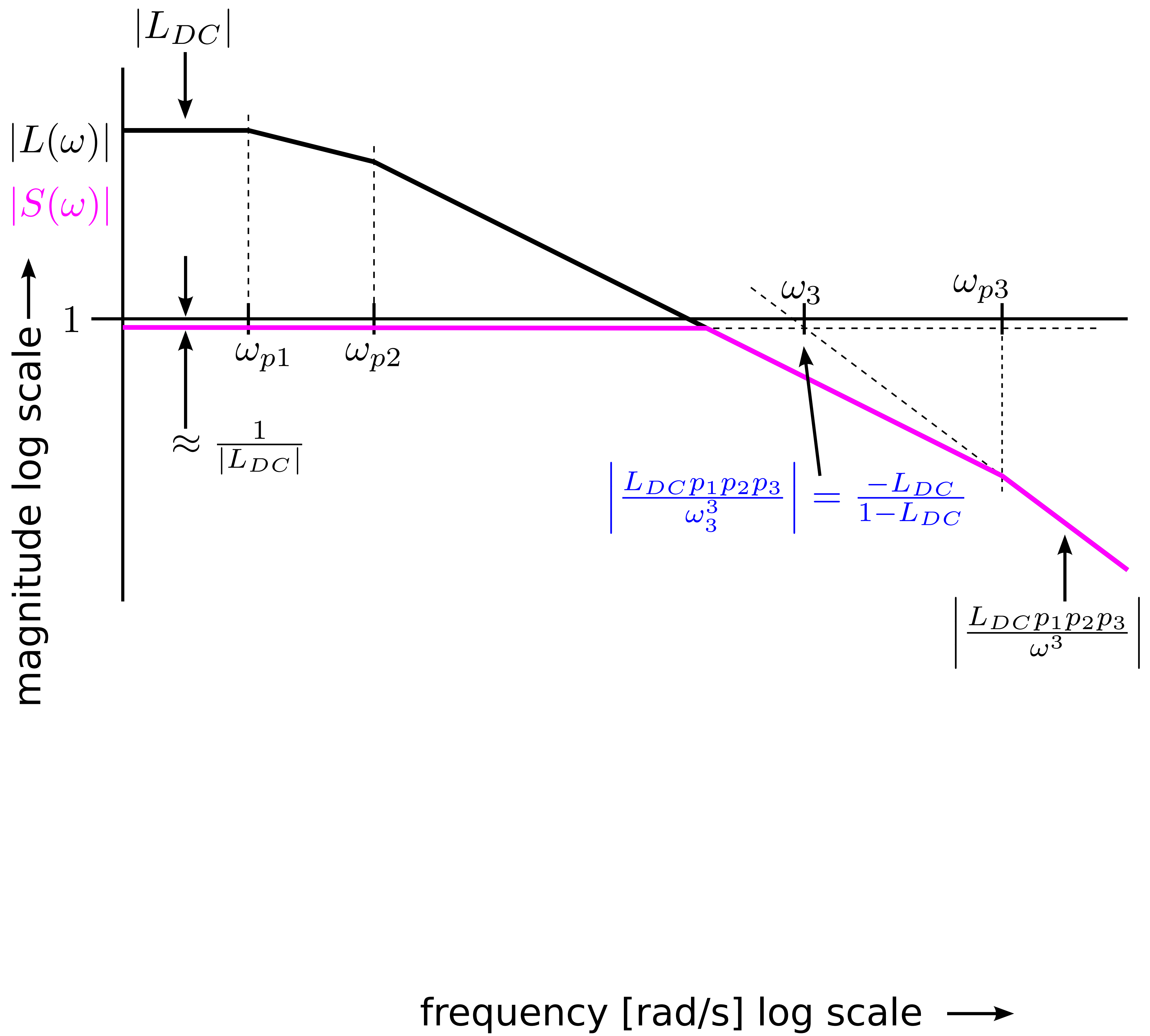


Magnitude plot with three separated negative real poles

$|L(\omega)|$

$|S(\omega)|$

Dominant and non-dominant poles

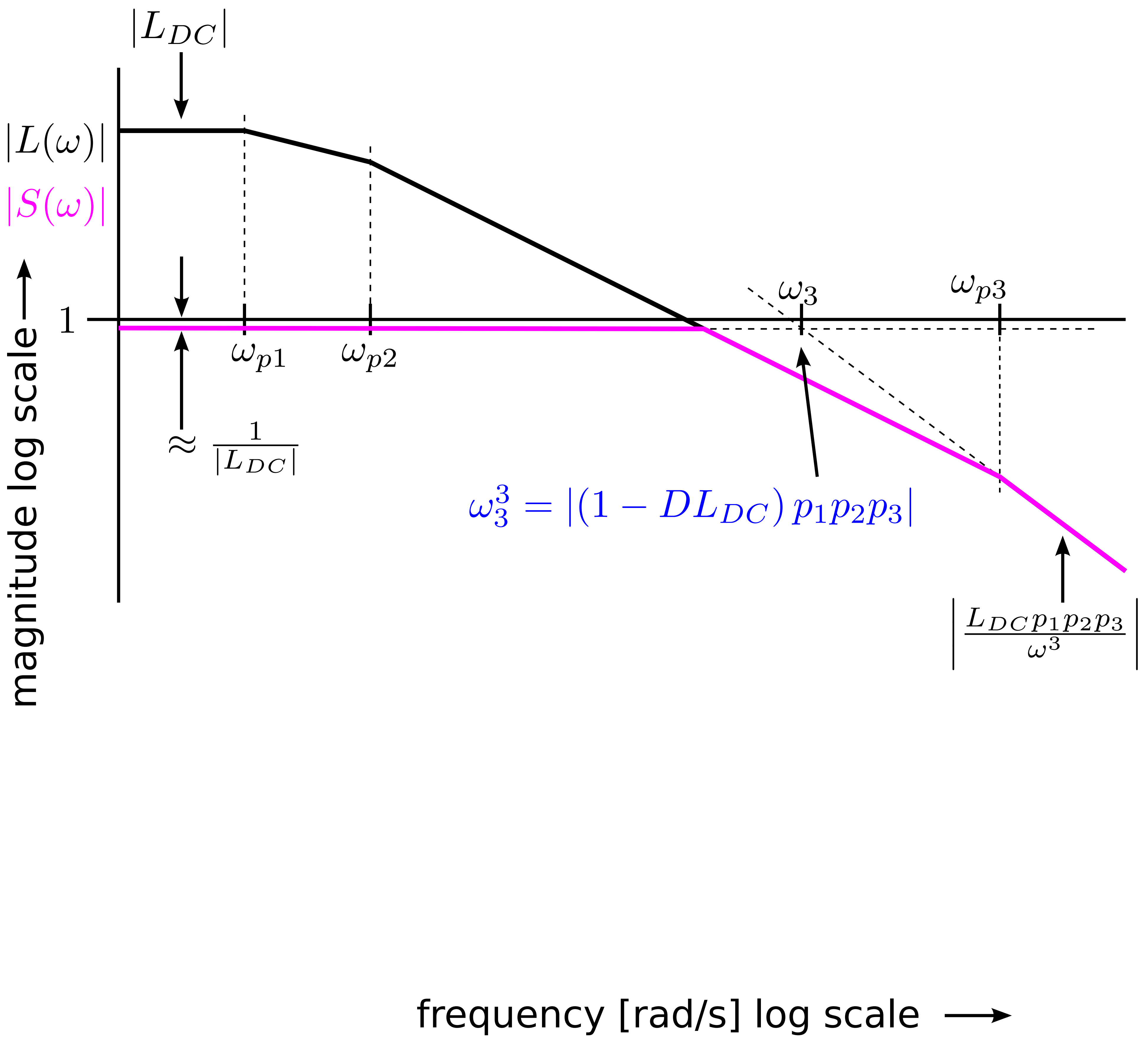


Magnitude plot with three separated negative real poles

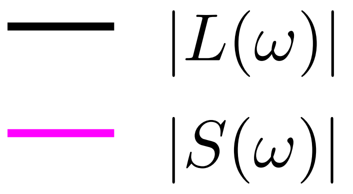
$|L(\omega)|$

$|S(\omega)|$

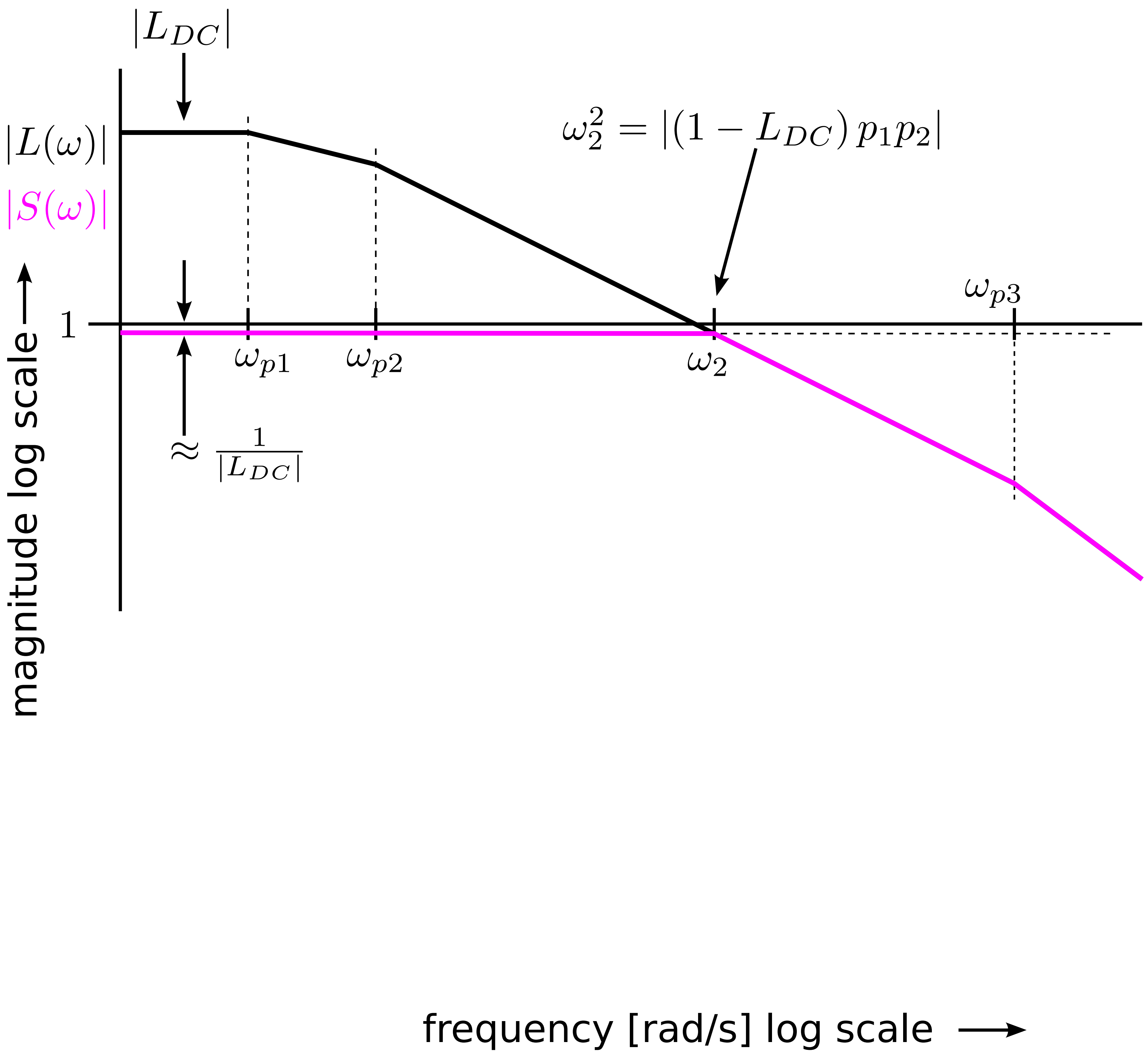
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles



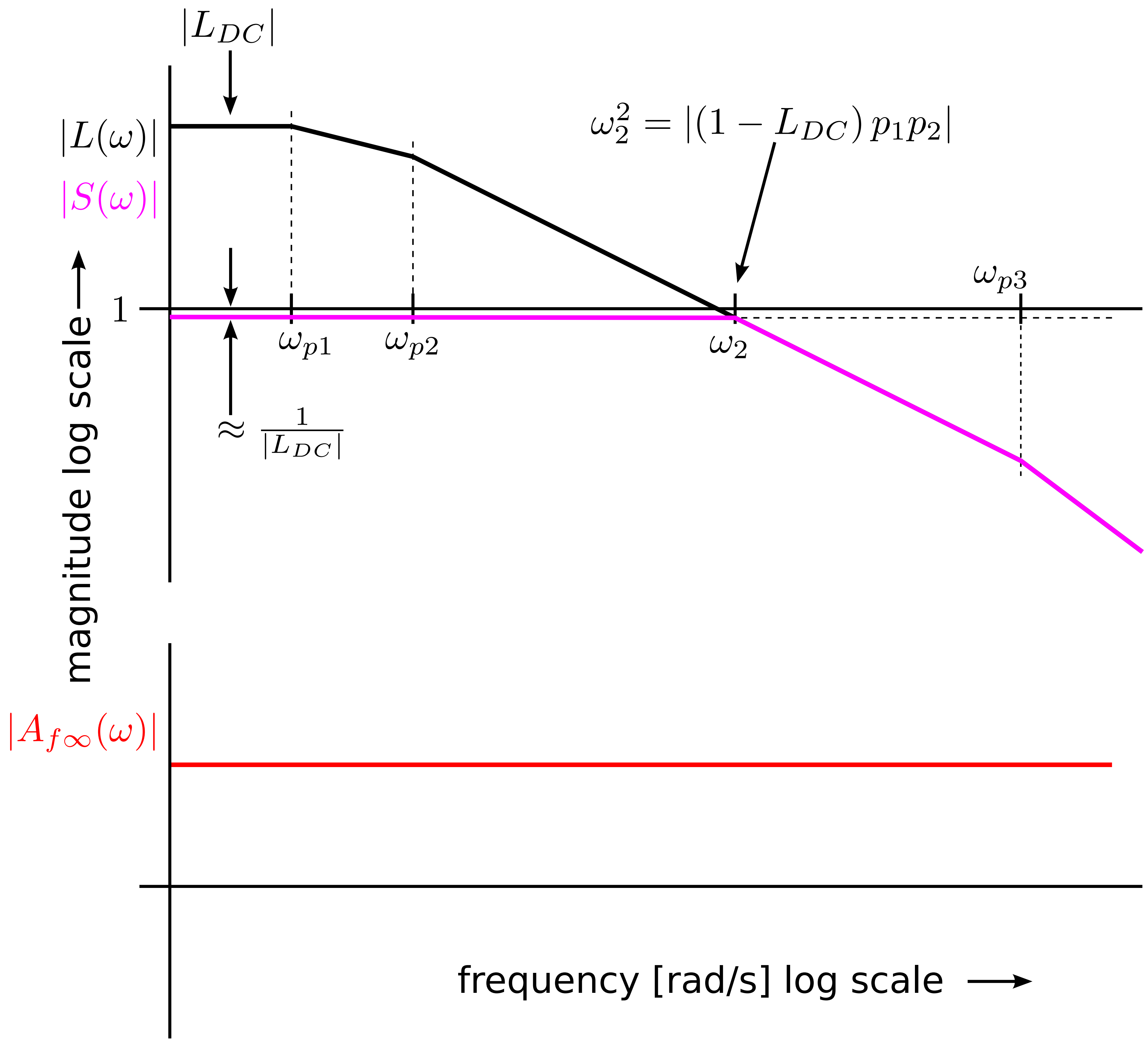
Dominant and non-dominant poles



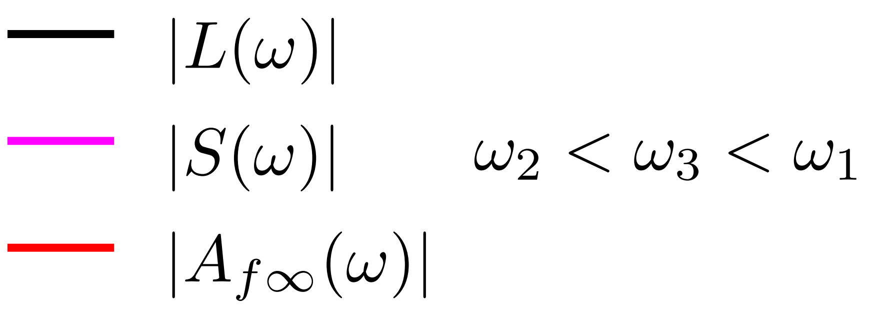
Magnitude plot with three separated negative real poles

$\omega_2 < \omega_3 < \omega_1$

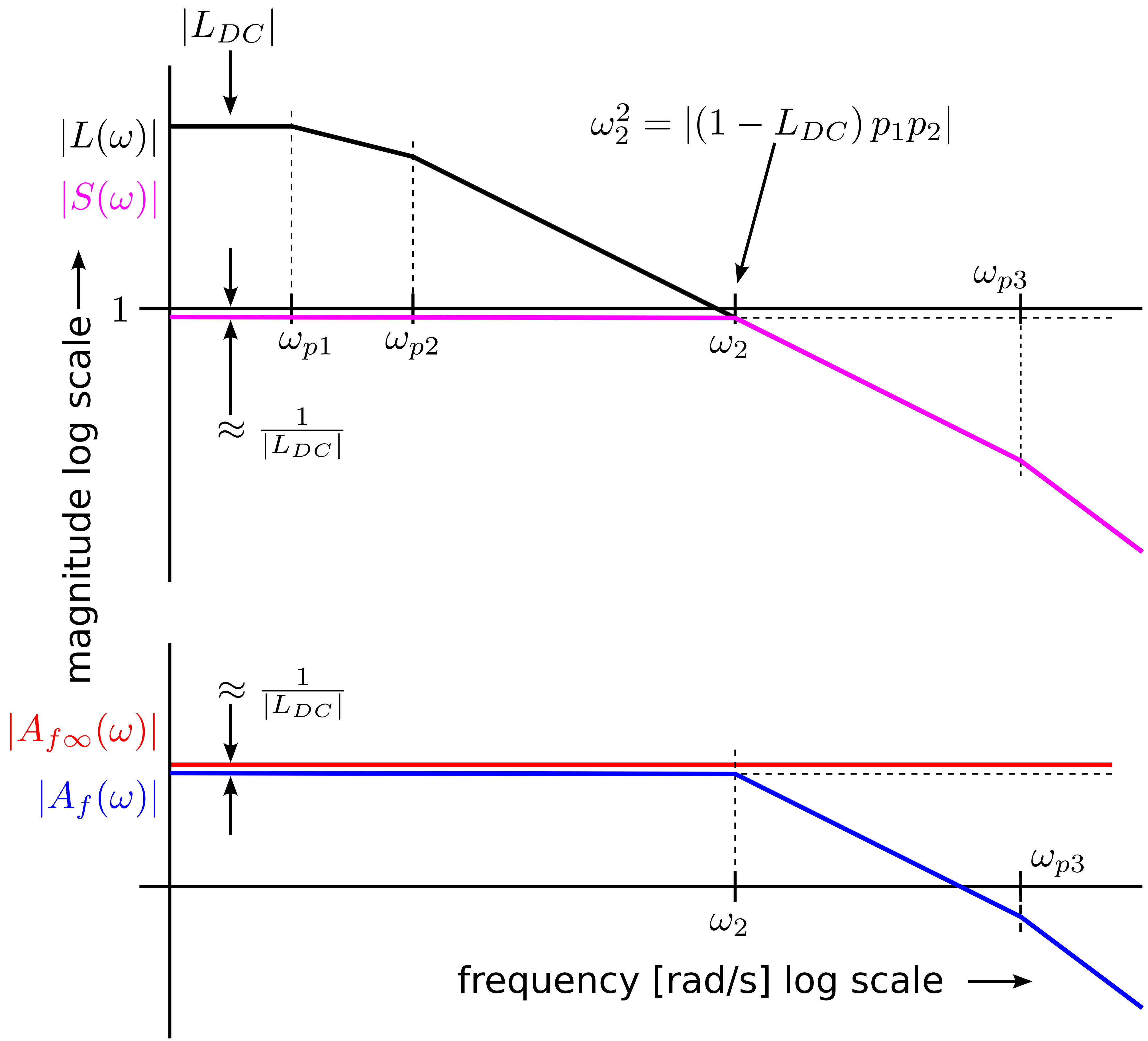
Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

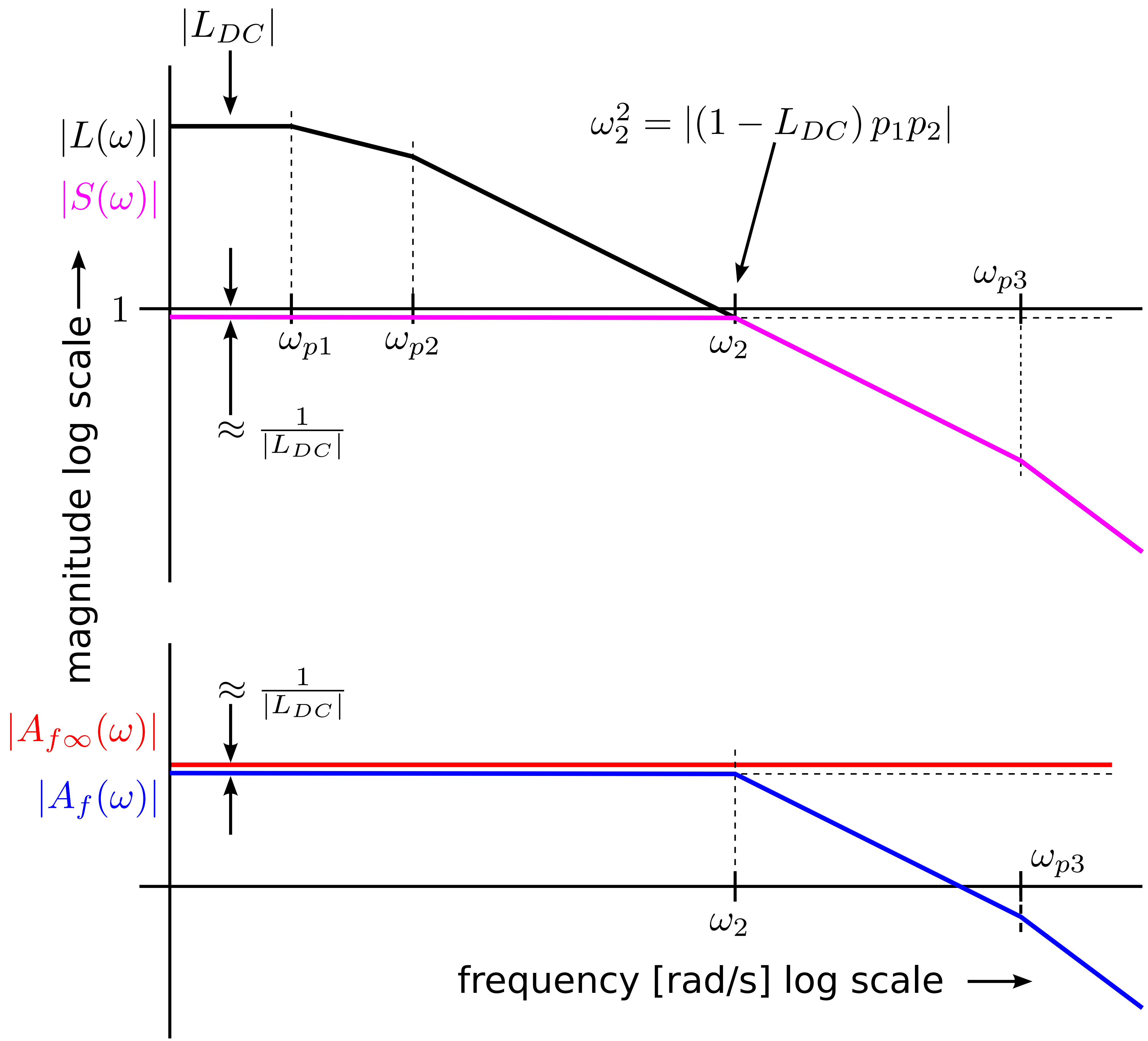


Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

Dominant and non-dominant poles

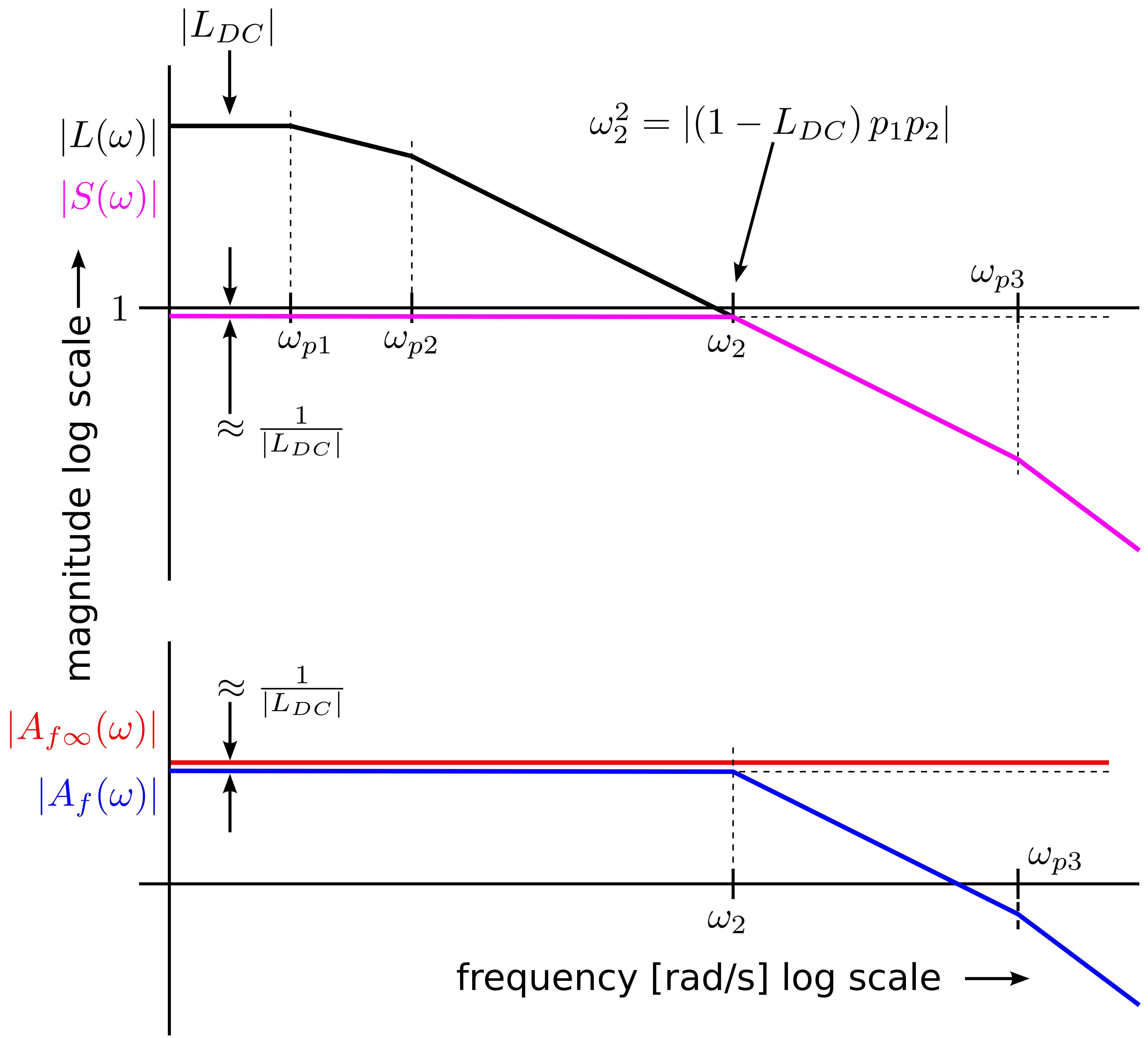


Magnitude plot with three separated negative real poles

- $|L(\omega)|$
- $|S(\omega)|$ $\qquad \omega_2 < \omega_3 < \omega_1$
- $|A_{f\infty}(\omega)|$
- $|A_f(\omega)|$

Dominant poles:
p_1, p_2

Dominant and non-dominant poles



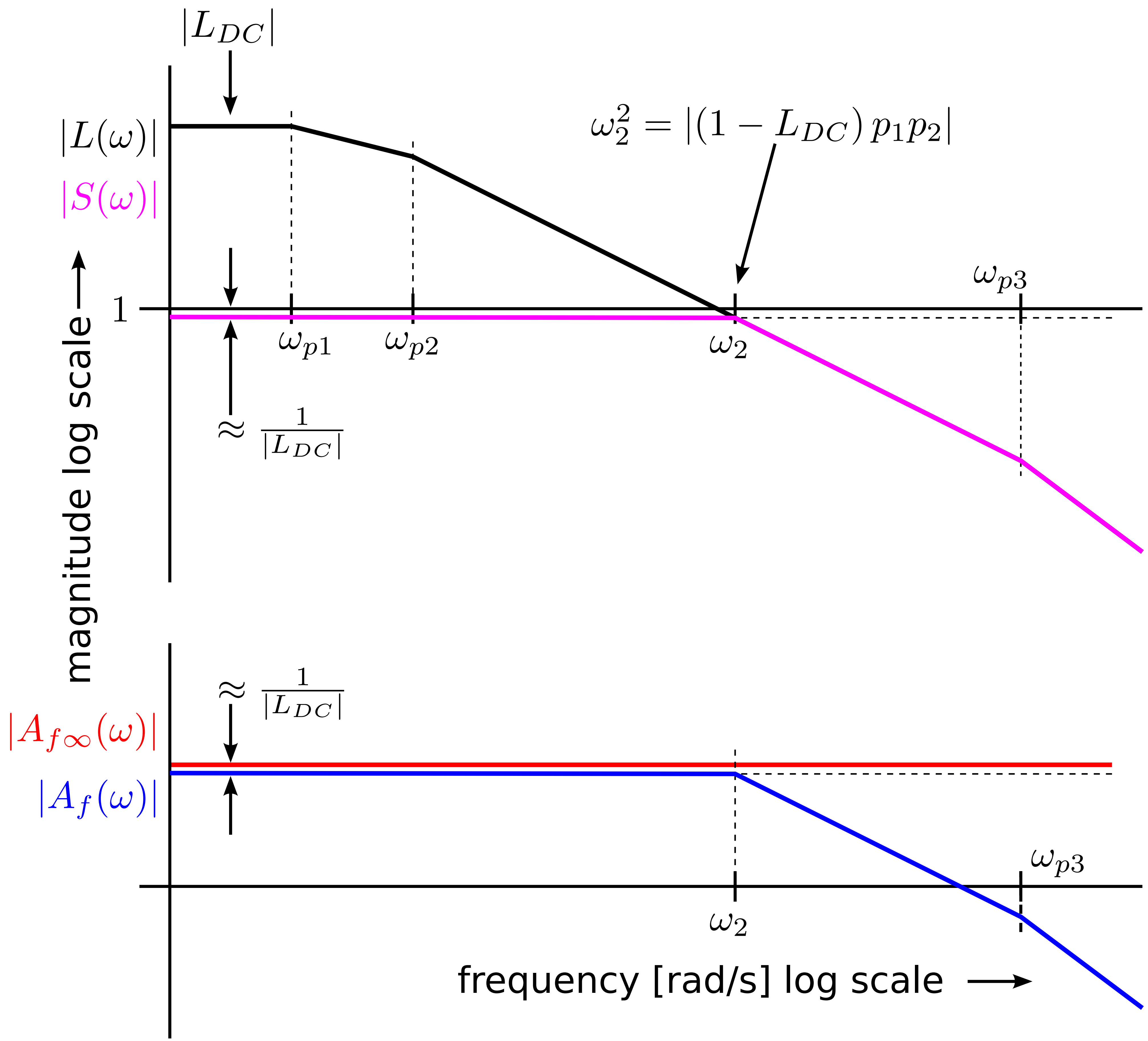
Magnitude plot with three separated negative real poles

- $|L(\omega)|$
- $|S(\omega)|$ $\quad \omega_2 < \omega_3 < \omega_1$
- $|A_{f\infty}(\omega)|$
- $|A_f(\omega)|$

Dominant poles:
p_1, p_2

Non-dominant pole:
p_3

Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

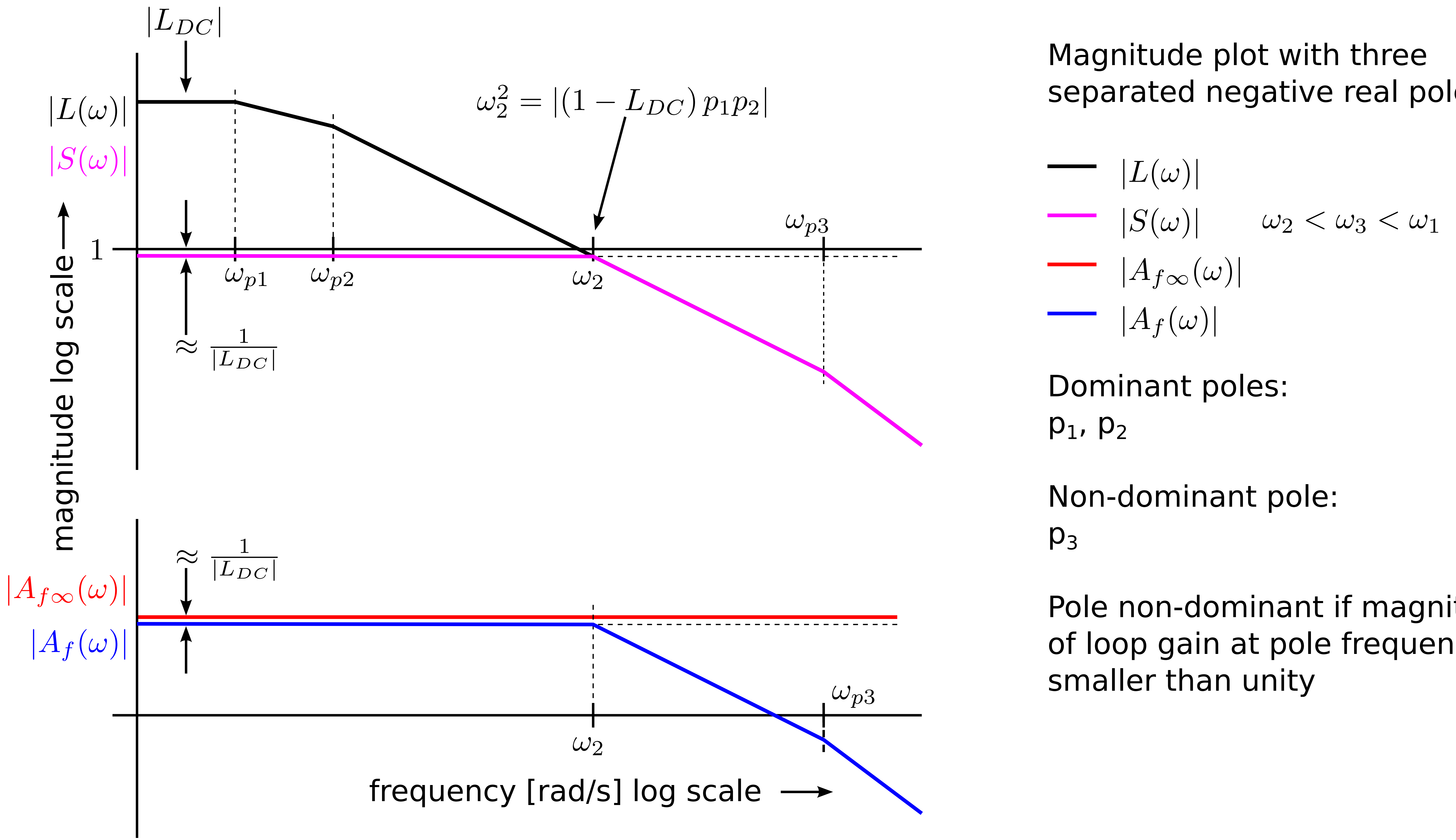
- $|L(\omega)|$
- $|S(\omega)|$ $\omega_2 < \omega_3 < \omega_1$
- $|A_{f\infty}(\omega)|$
- $|A_f(\omega)|$

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

Dominant and non-dominant poles



Magnitude plot with three separated negative real poles

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

Procedure for determination of the dominant poles

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

Procedure for determination of the dominant poles

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

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

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:

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:

$$\omega_1 = |(1 - L_{DC})\, p_1|$$

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:

$$\omega_1 = |(1 - L_{DC})\, p_1|\,,$$

$$\omega_2 = \sqrt{|(1 - L_{DC})\, p_1 p_2|}$$

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:

$$\omega_1 = |(1 - L_{DC})\, p_1|\,,$$

$$\omega_2 = \sqrt{|(1 - L_{DC})\, p_1 p_2|},$$

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

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:

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

3. Stop this procedure if cut-off frequency increases

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:

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

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

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:

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

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

