Structured Electronic Design

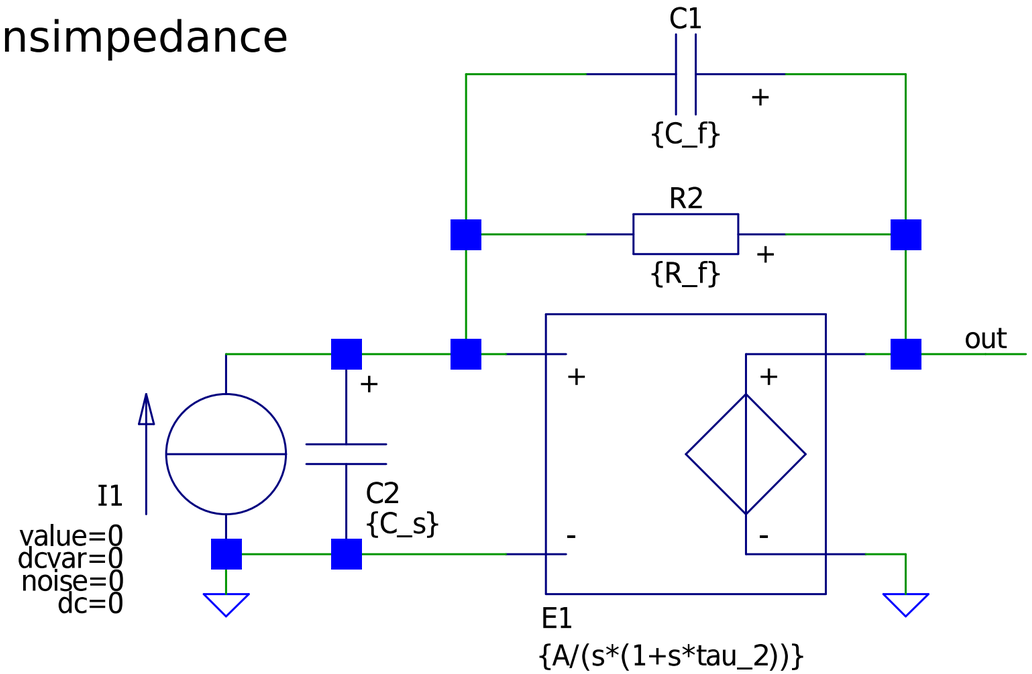
EE4109
Bandwidth limitation
with phantom zeros

Anton J.M. Montagne

Phantom zero compensation

Phantom zero compensation

Transimpedance



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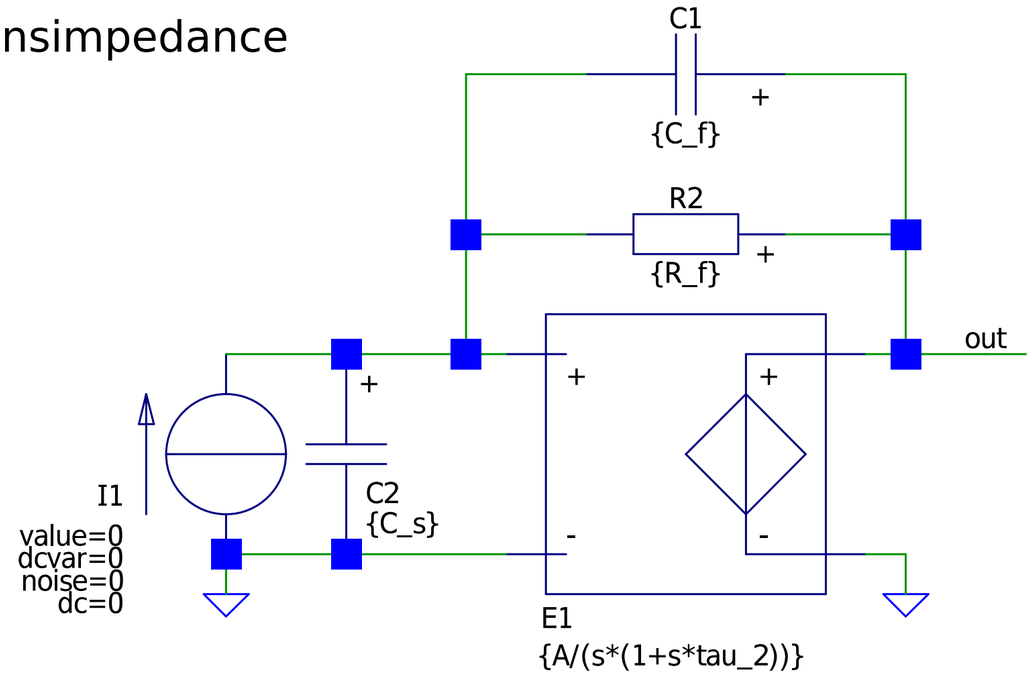

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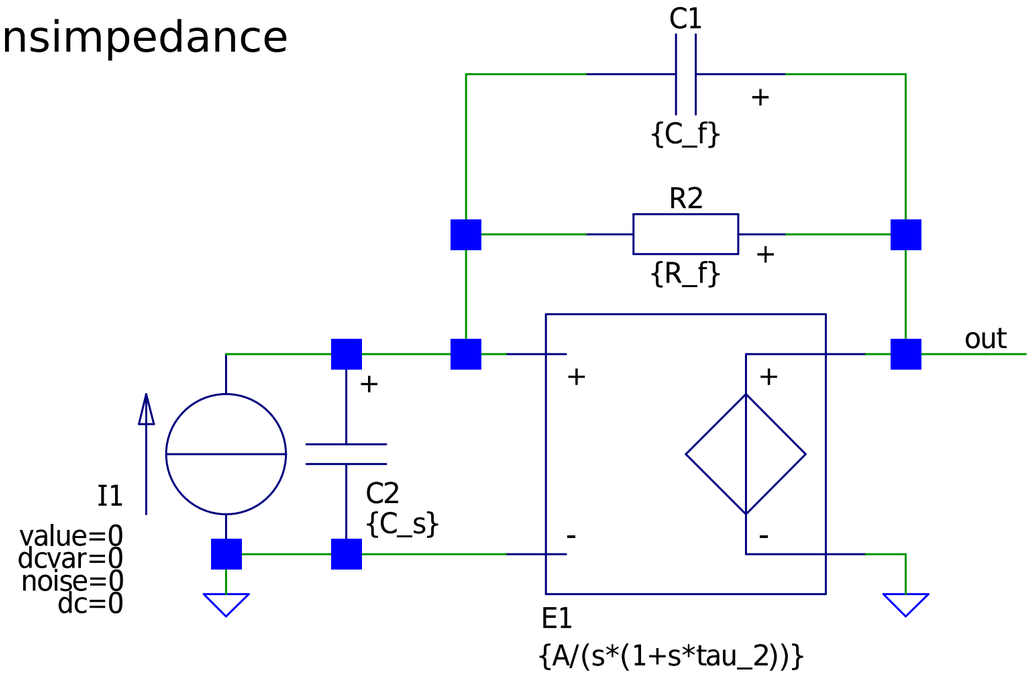

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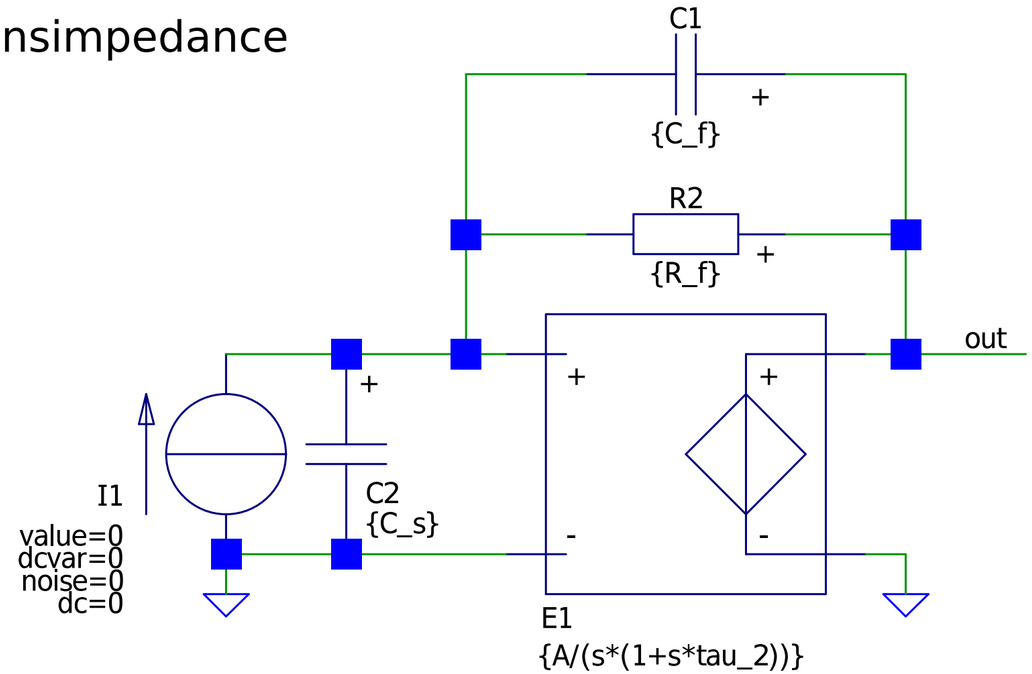

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How many loop gain poles?

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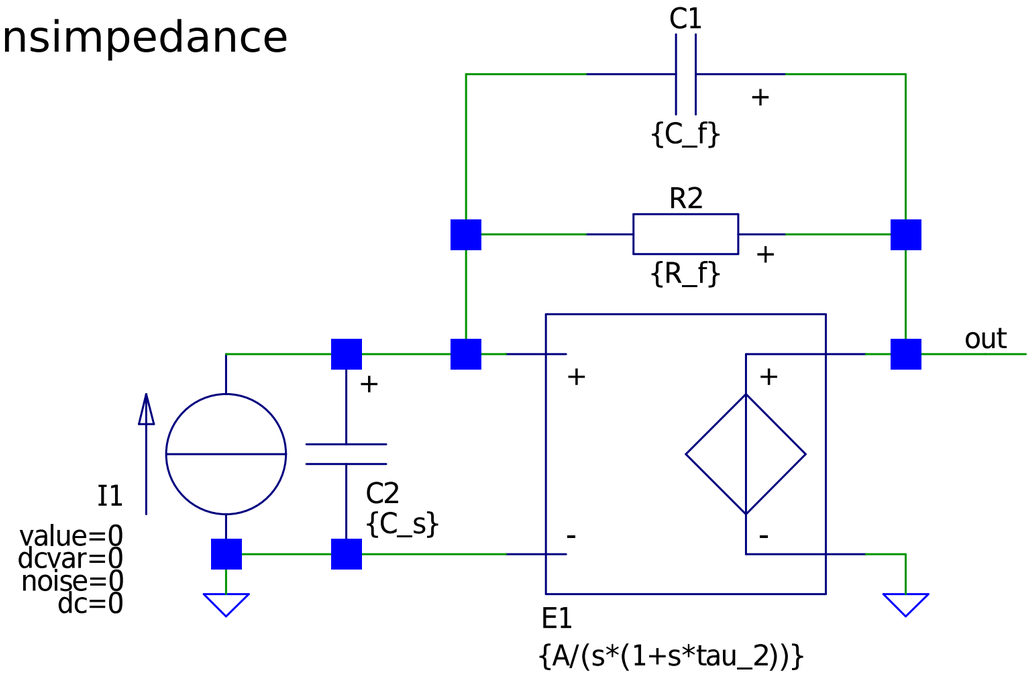

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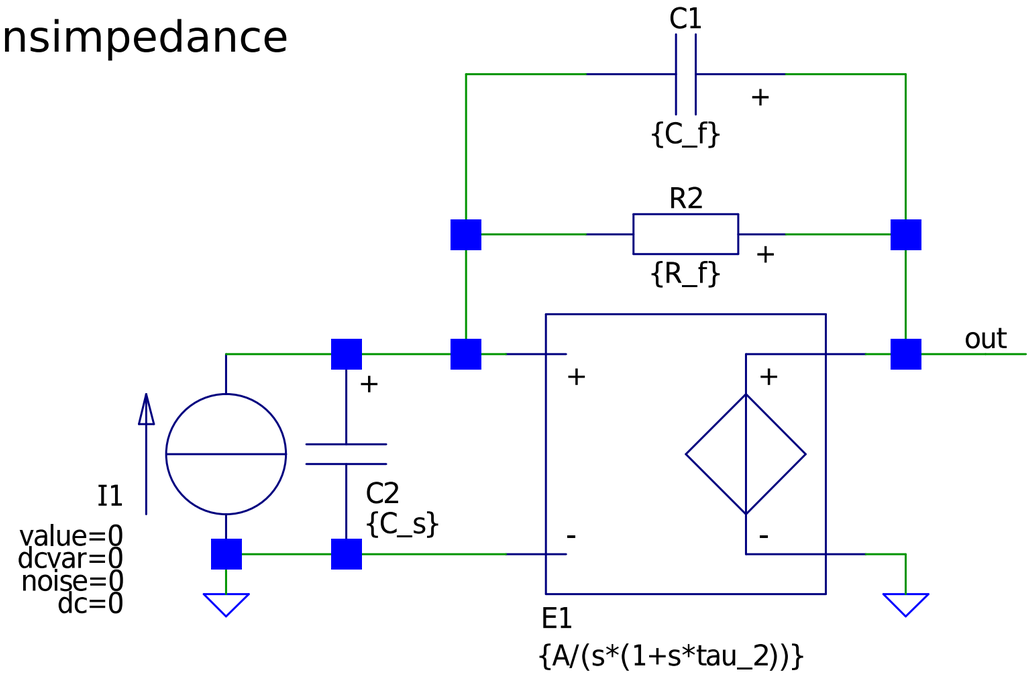

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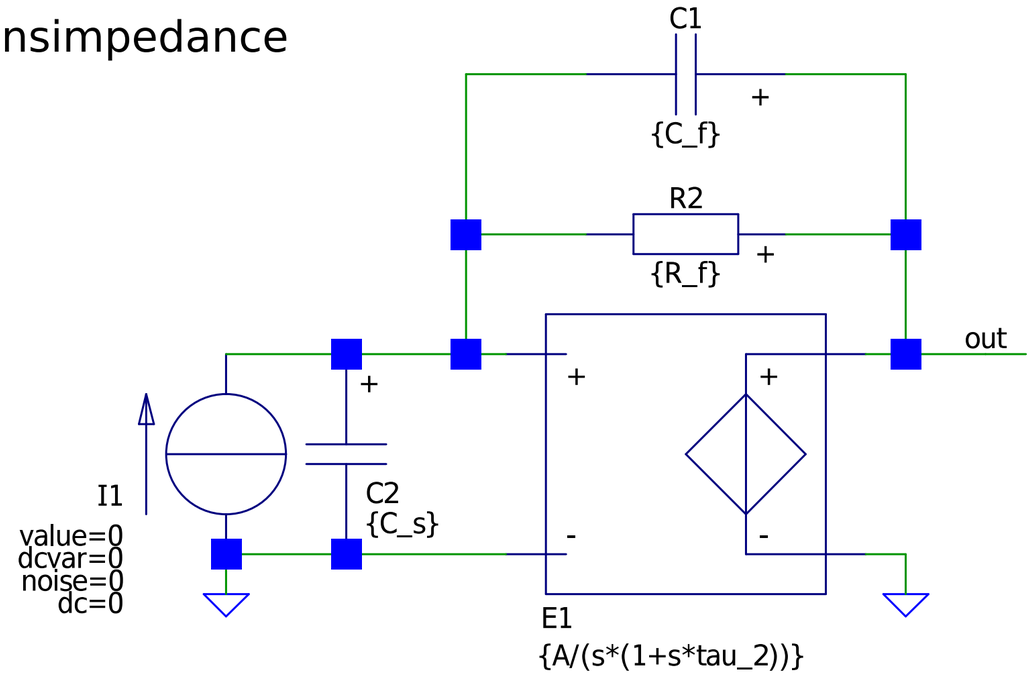

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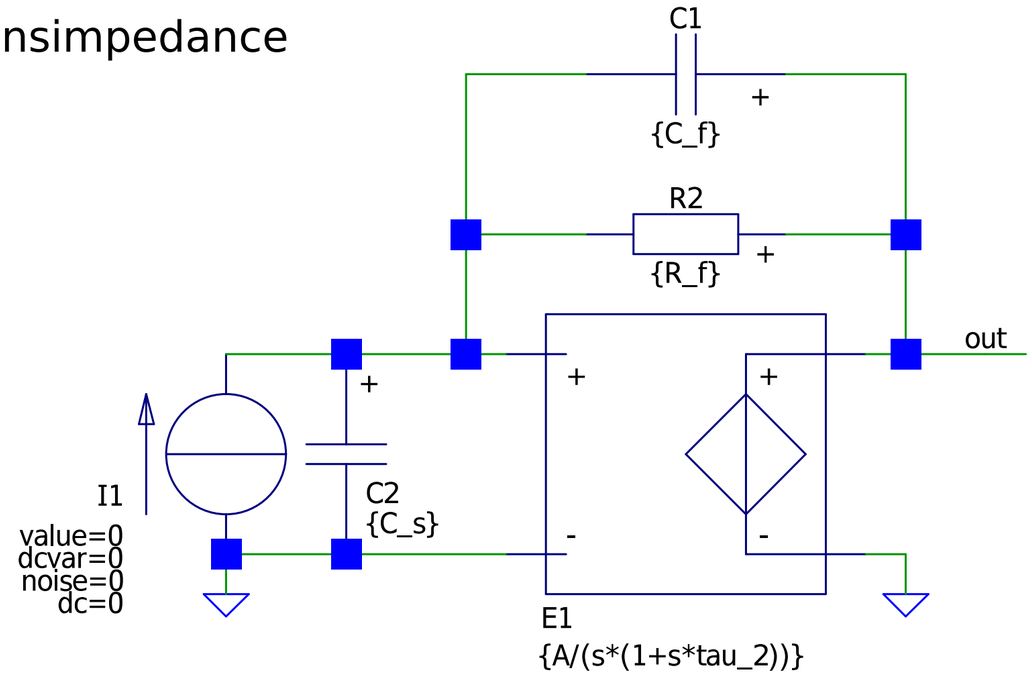

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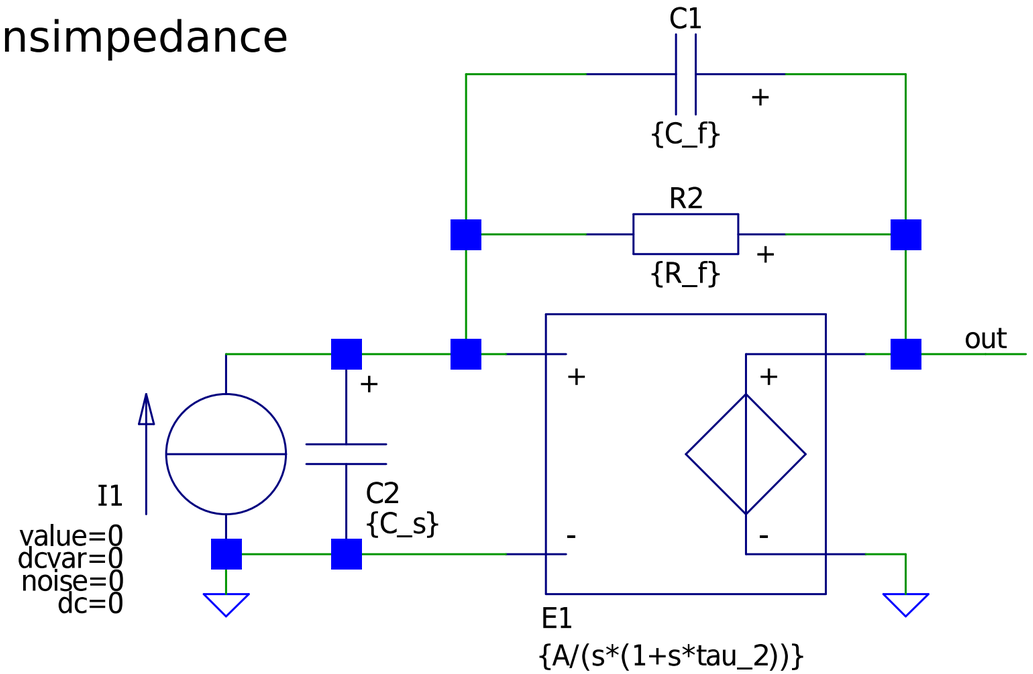

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$$C_f = \frac{\sqrt{2}B_f + p_1 + p_2}{2\pi B_f R_f^2} = 50\text{pF}$$

Phantom zero compensation

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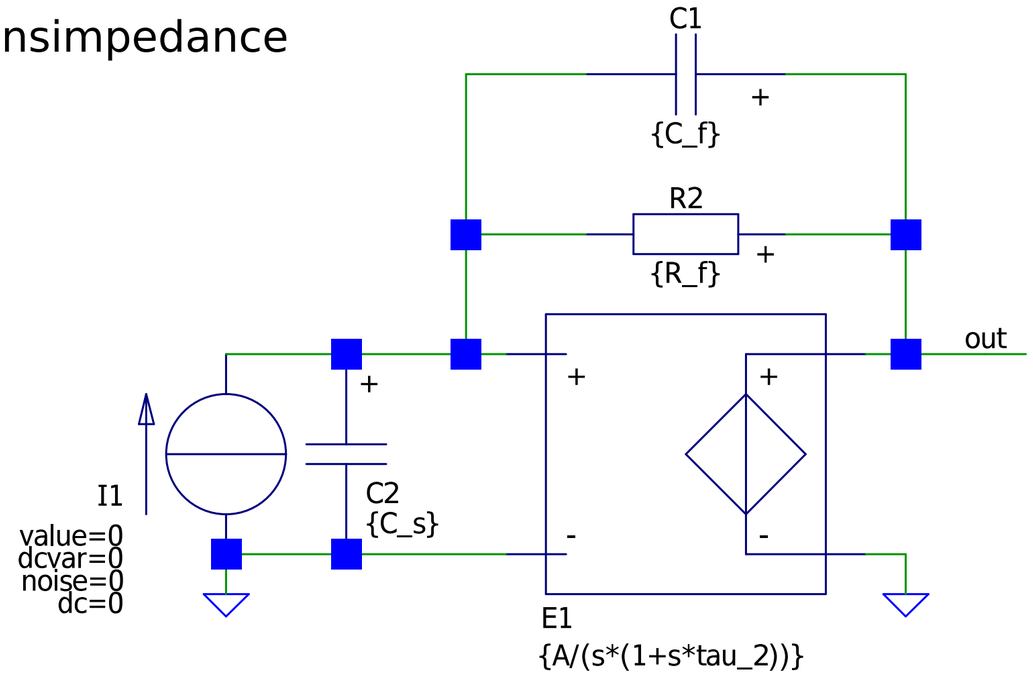

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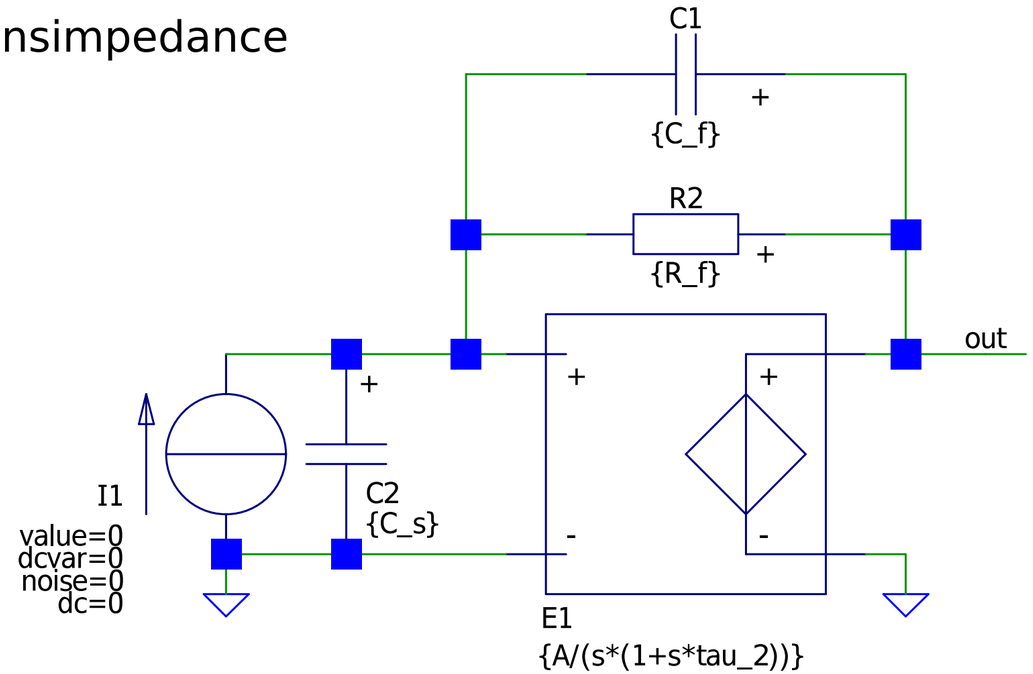

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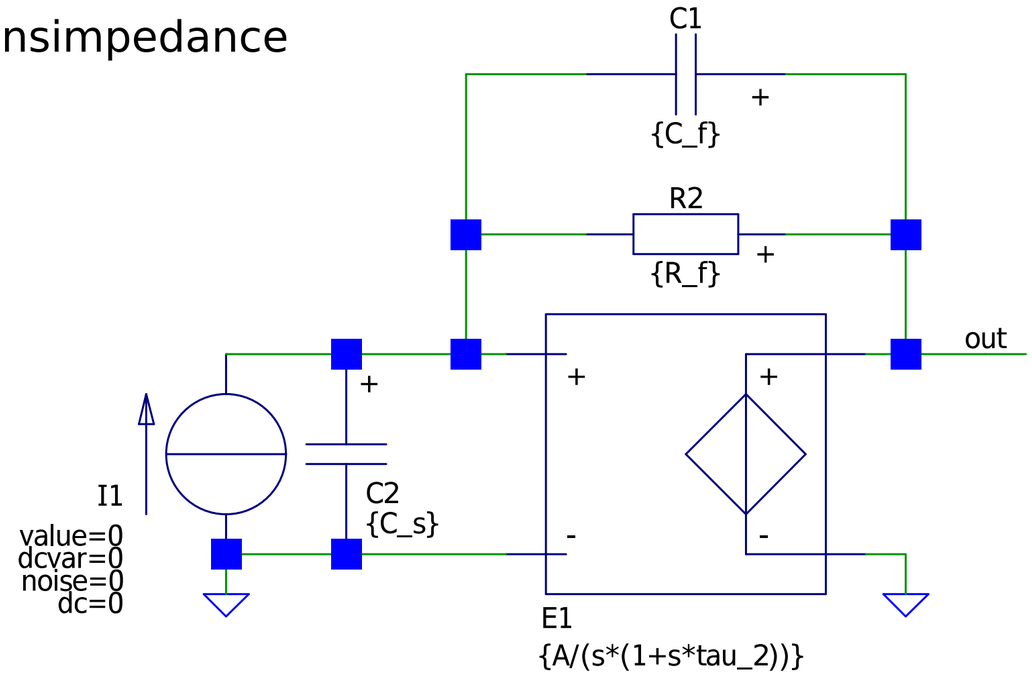

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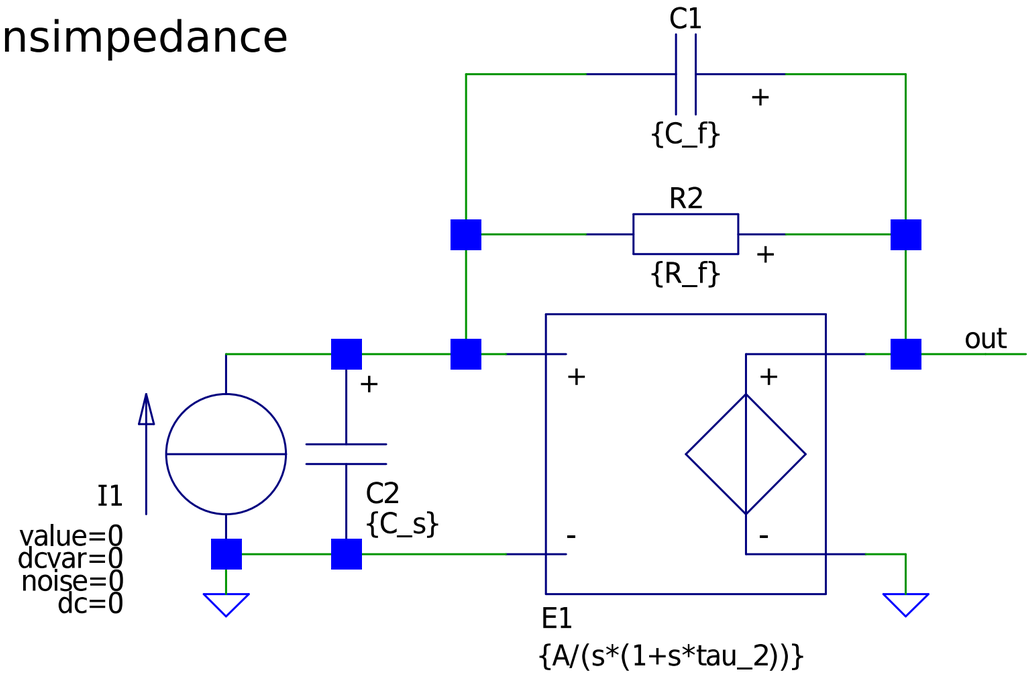

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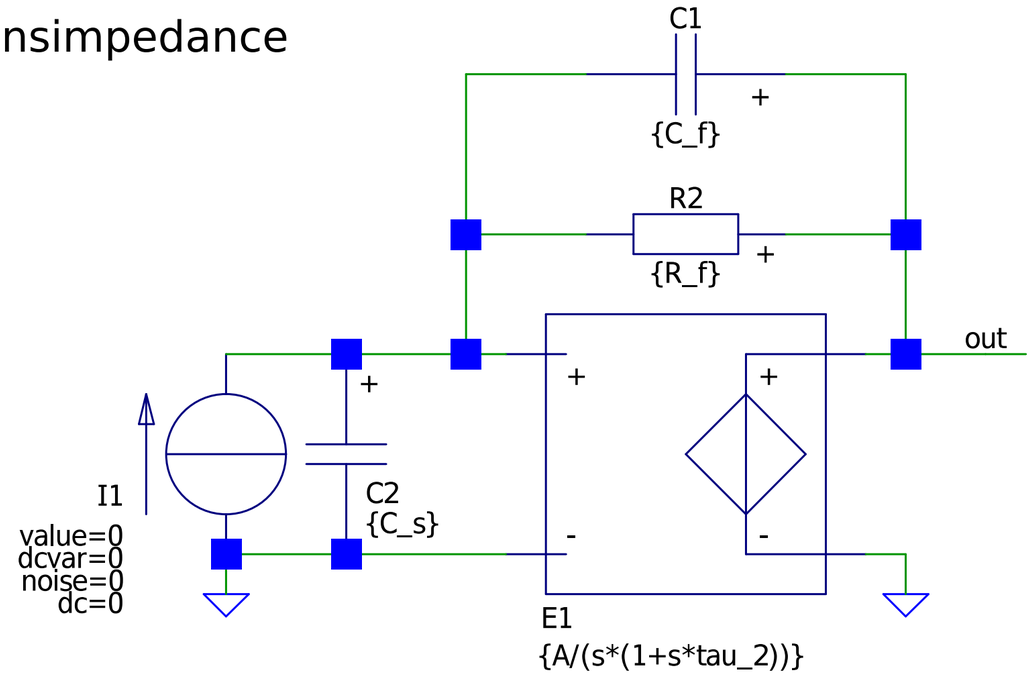

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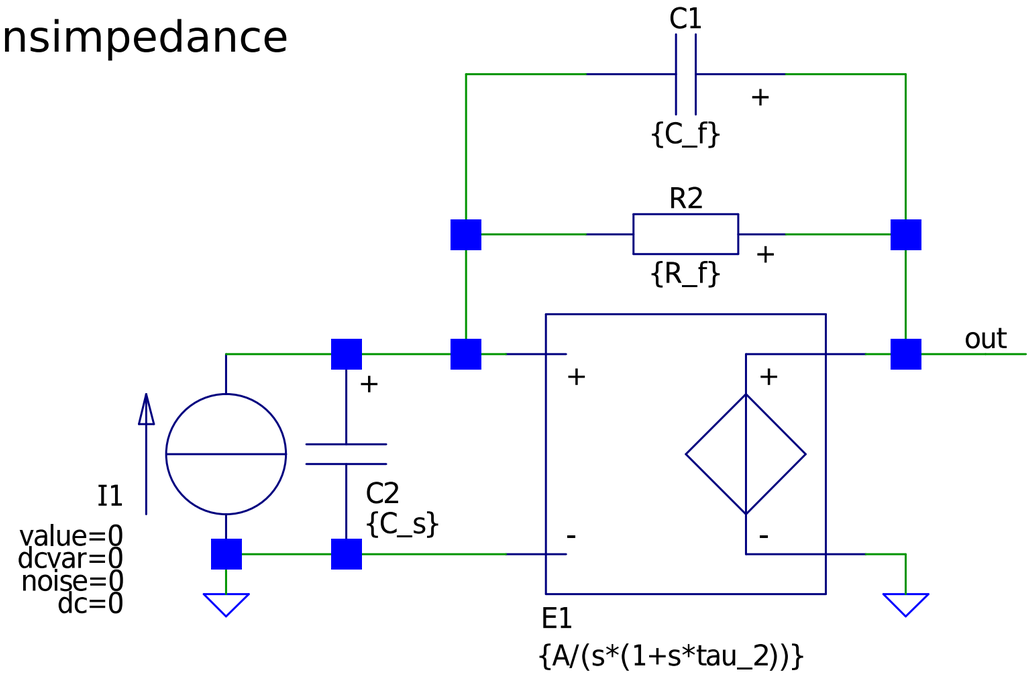

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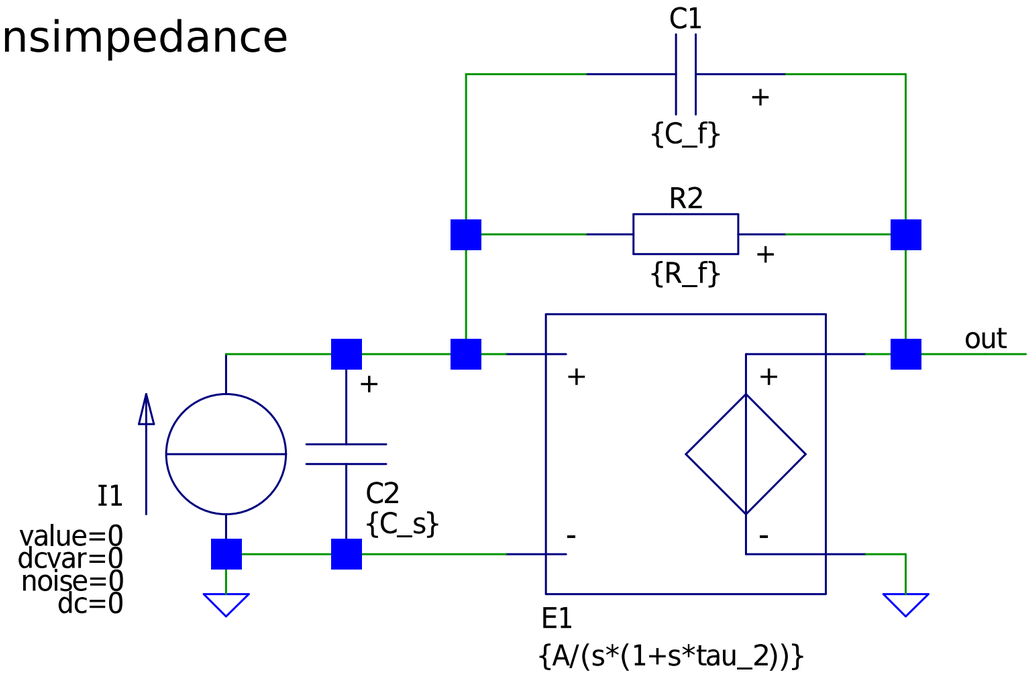

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Phantom zero:

Pole in asymptotic-gain

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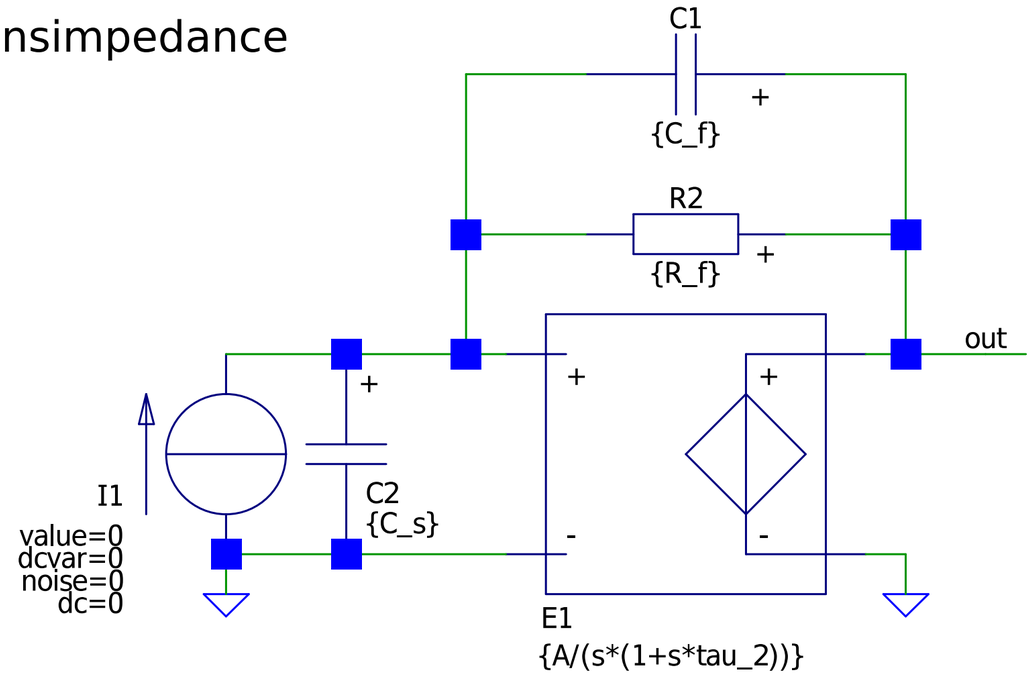

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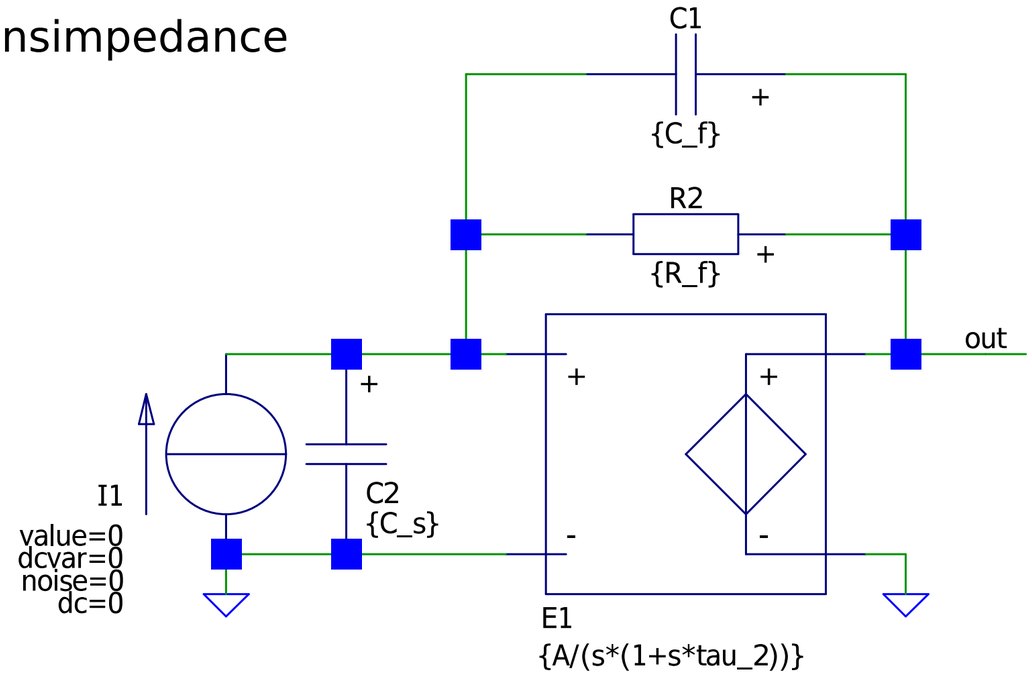

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Phantom zero:

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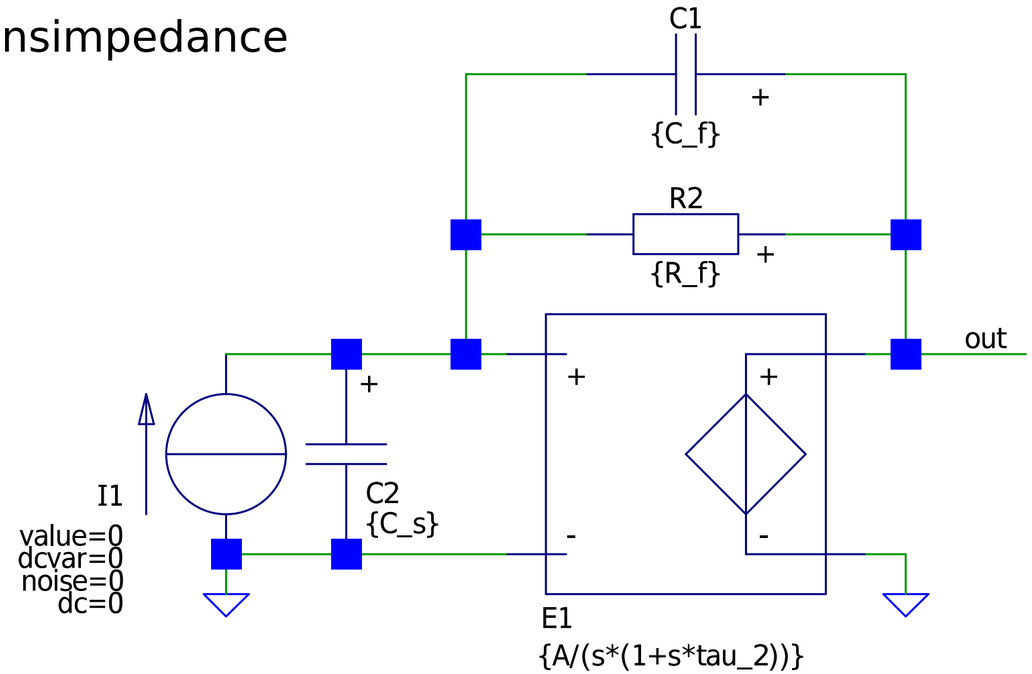

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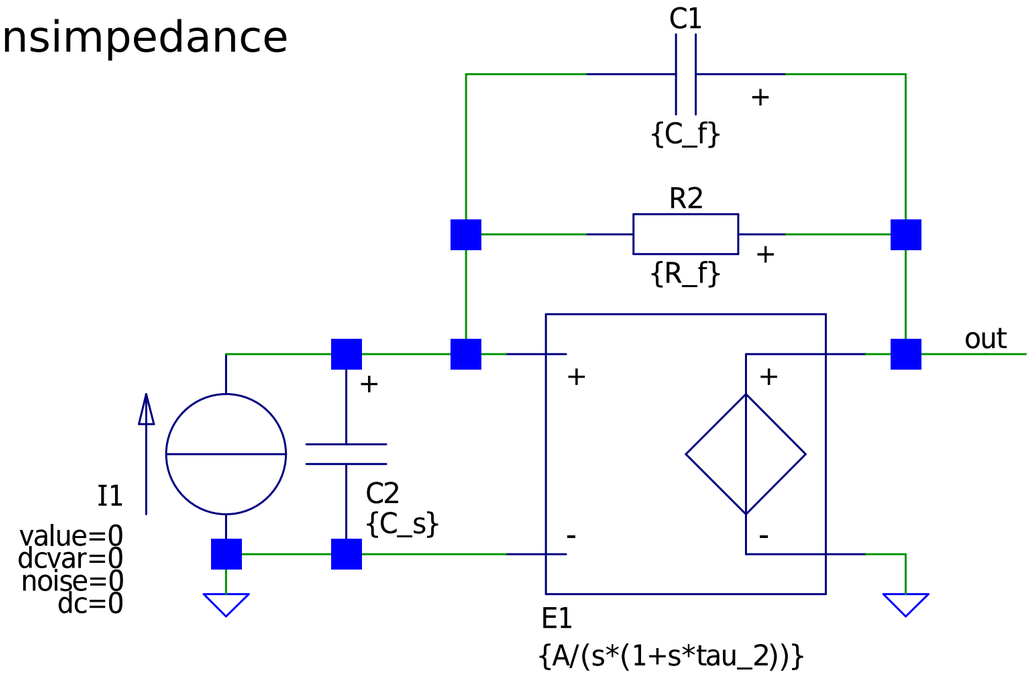

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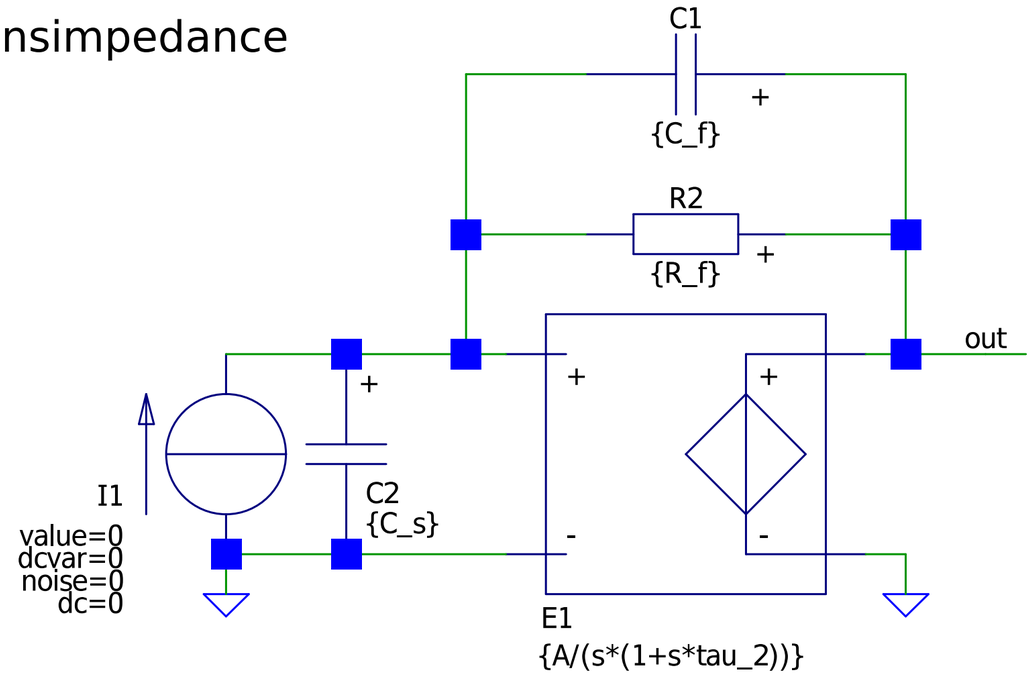

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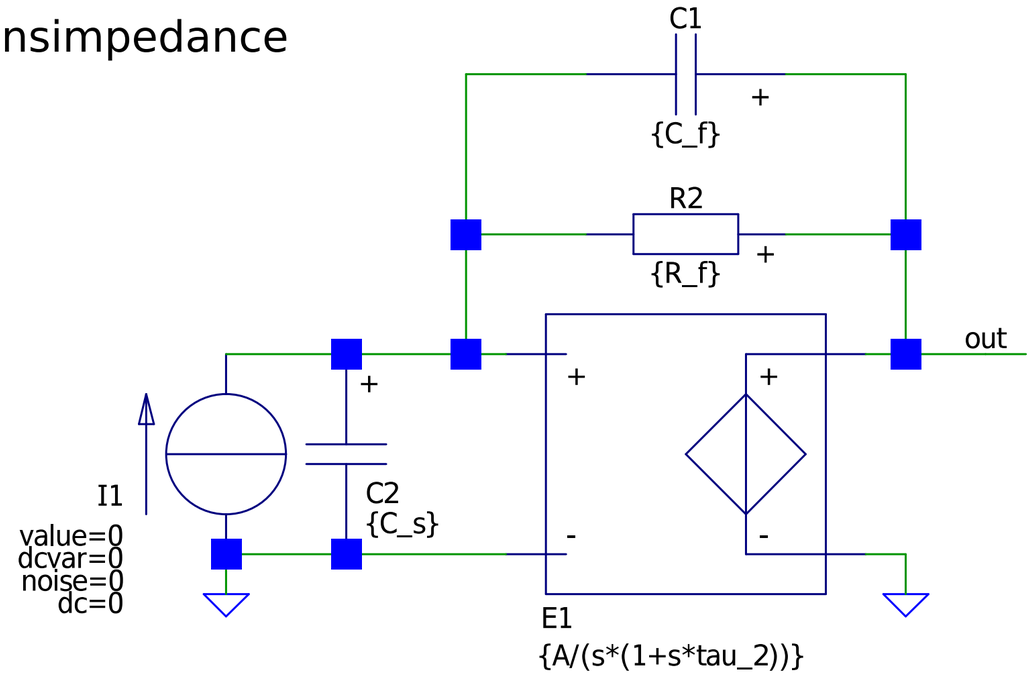

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Study root locus:

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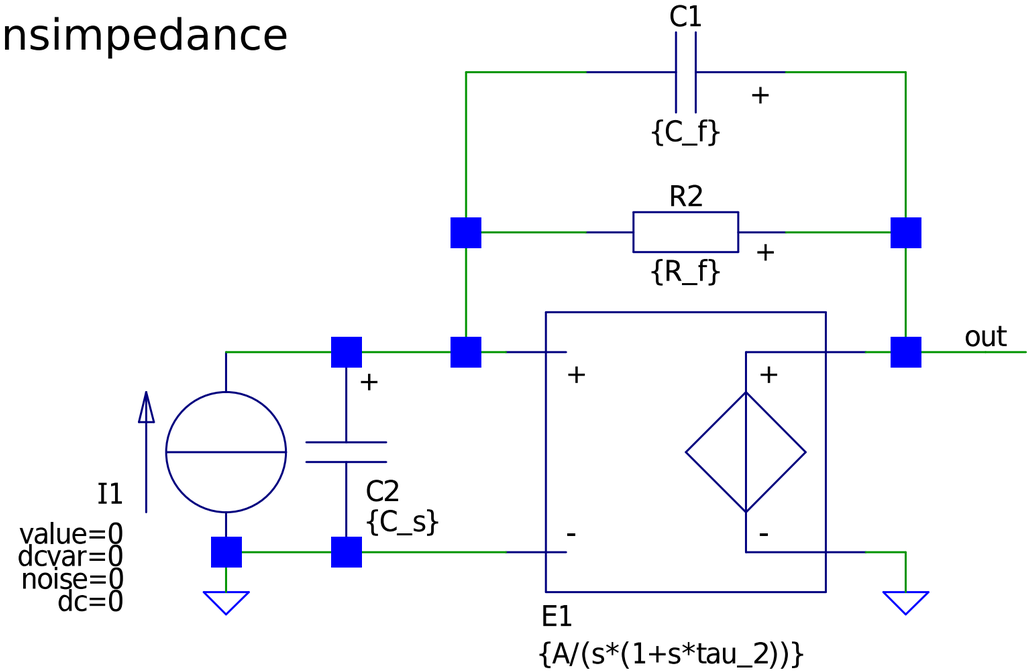

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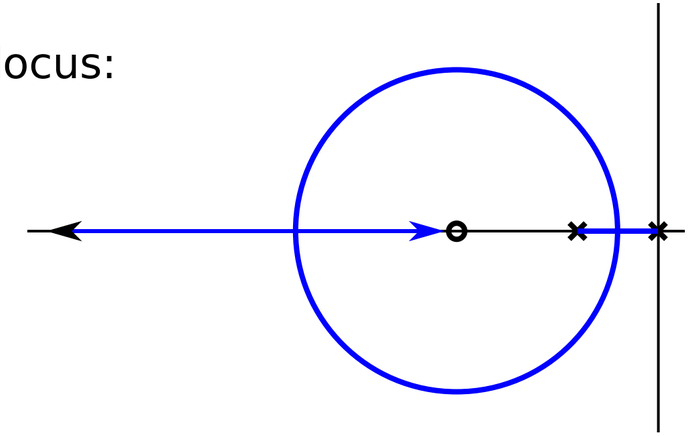

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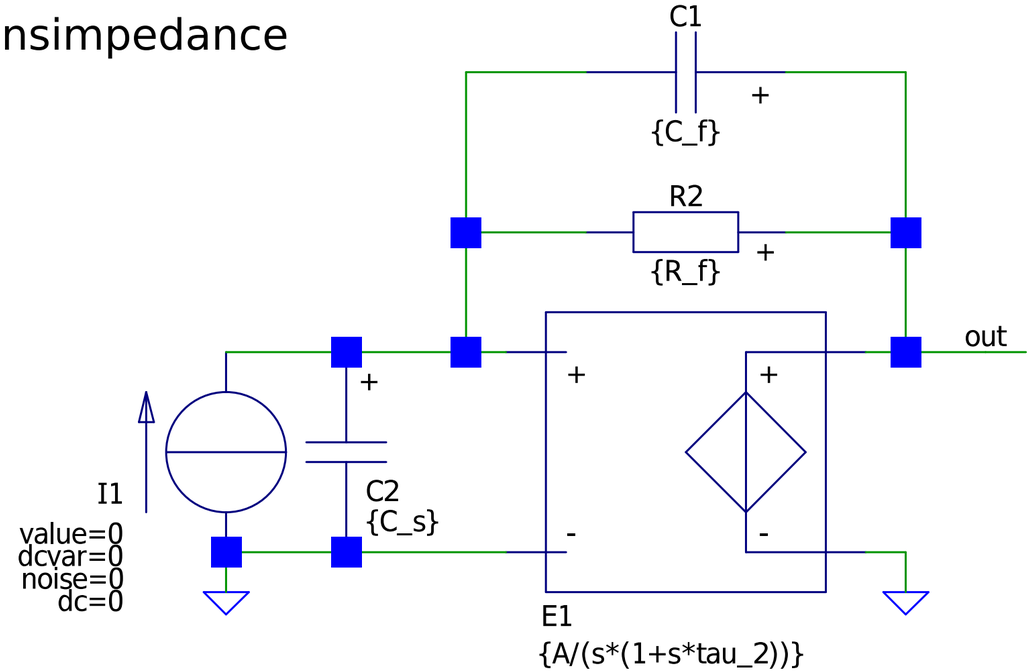

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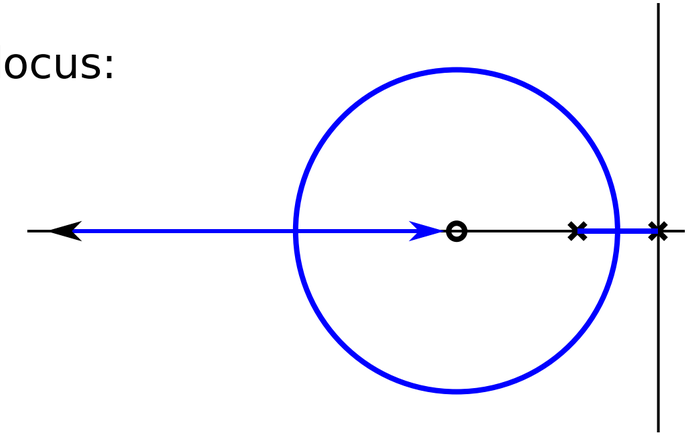

One of the poles of the loop gain moves towards the phantom zero!

Phantom zero bandwidth limitation

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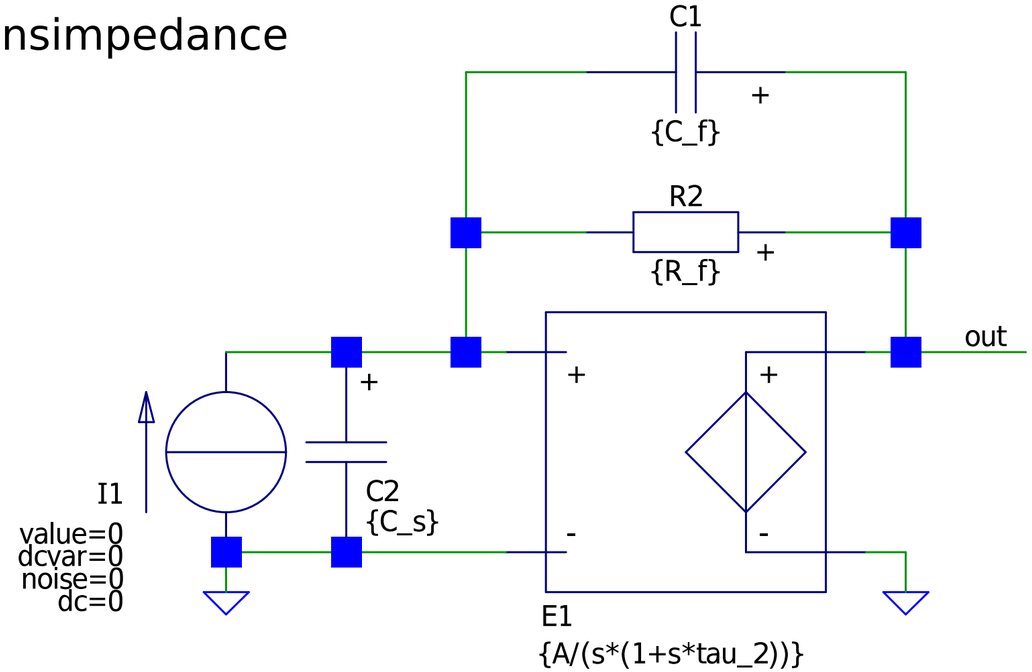

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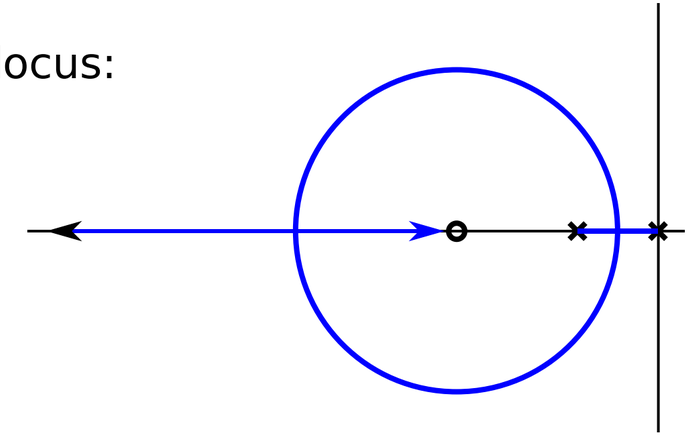

One of the poles of the loop gain moves towards the phantom zero!

This expains the bandwidth limitation

Phantom zero bandwidth limitation

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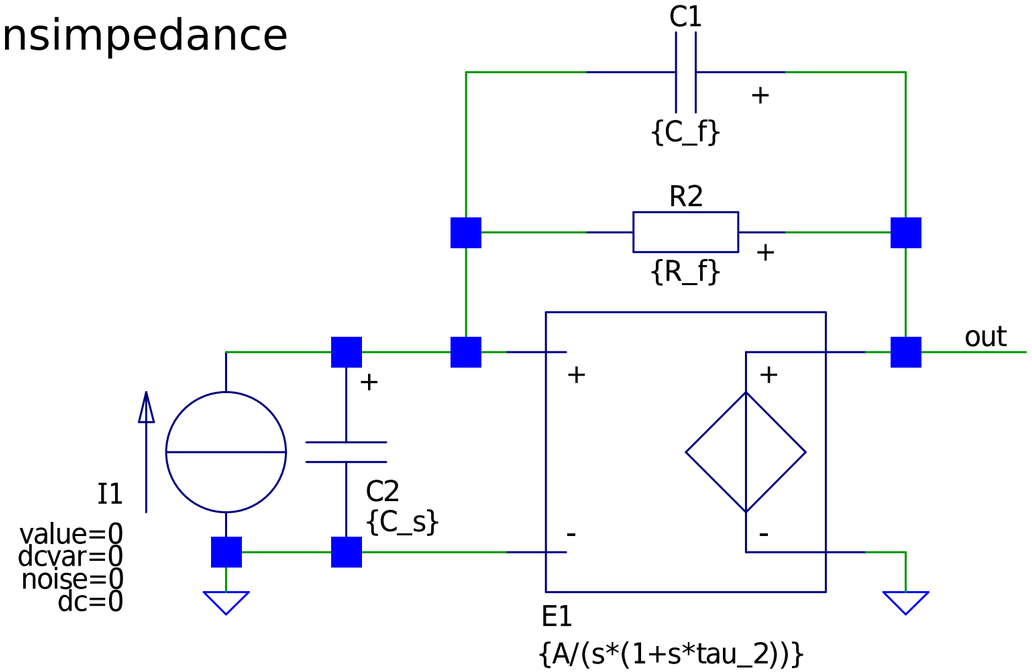

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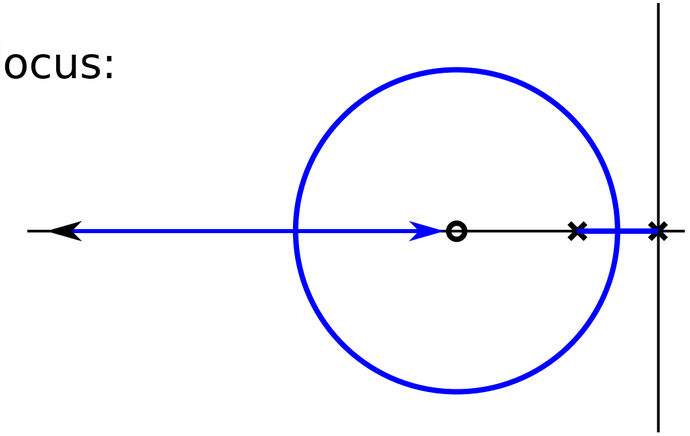

One of the poles of the loop gain moves towards the phantom zero!

- This expains the bandwidth limitation
- The servo bandwidth increases with the loop gain

Phantom zero bandwidth limitation

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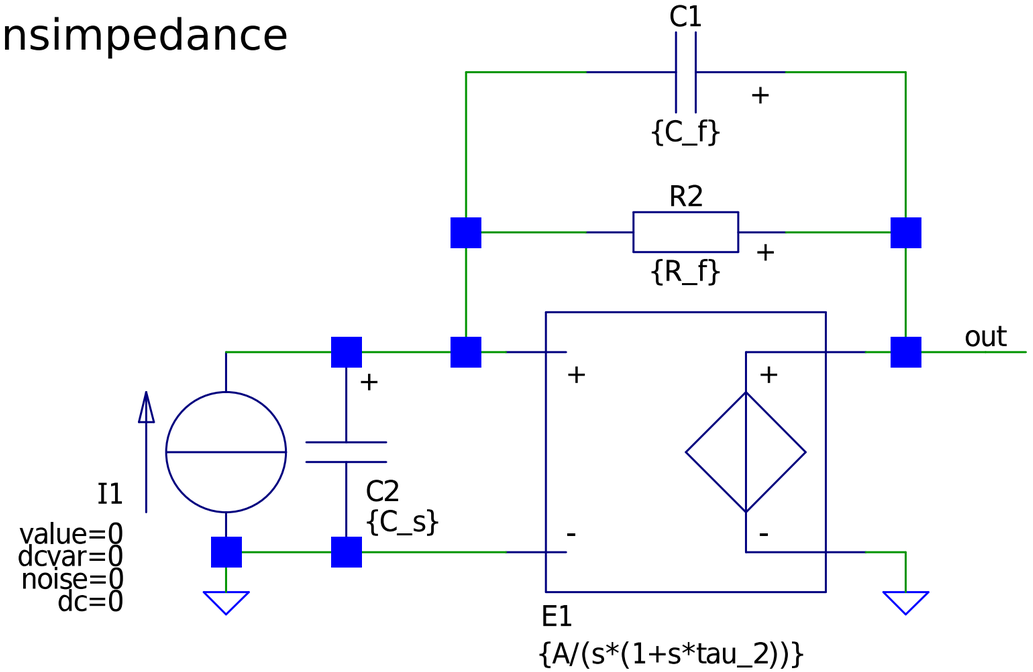

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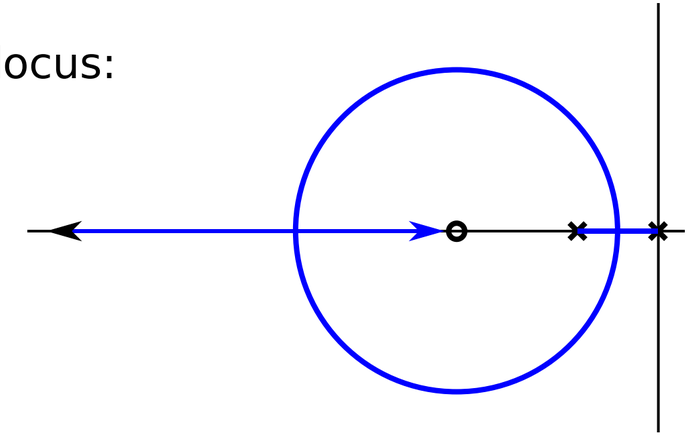


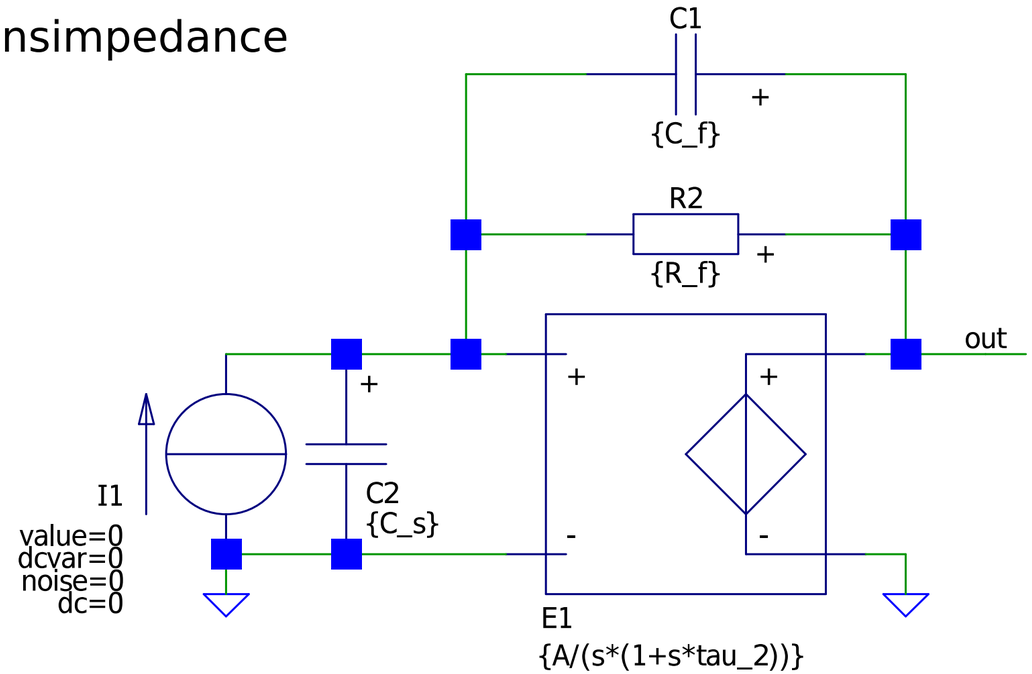
One of the poles of the loop gain moves towards the phantom zero!

- This expains the bandwidth limitation
- The servo bandwidth increases with the loop gain

Phantom zero bandwidth limitation

Phantom zero bandwidth limitation

Transimpedance



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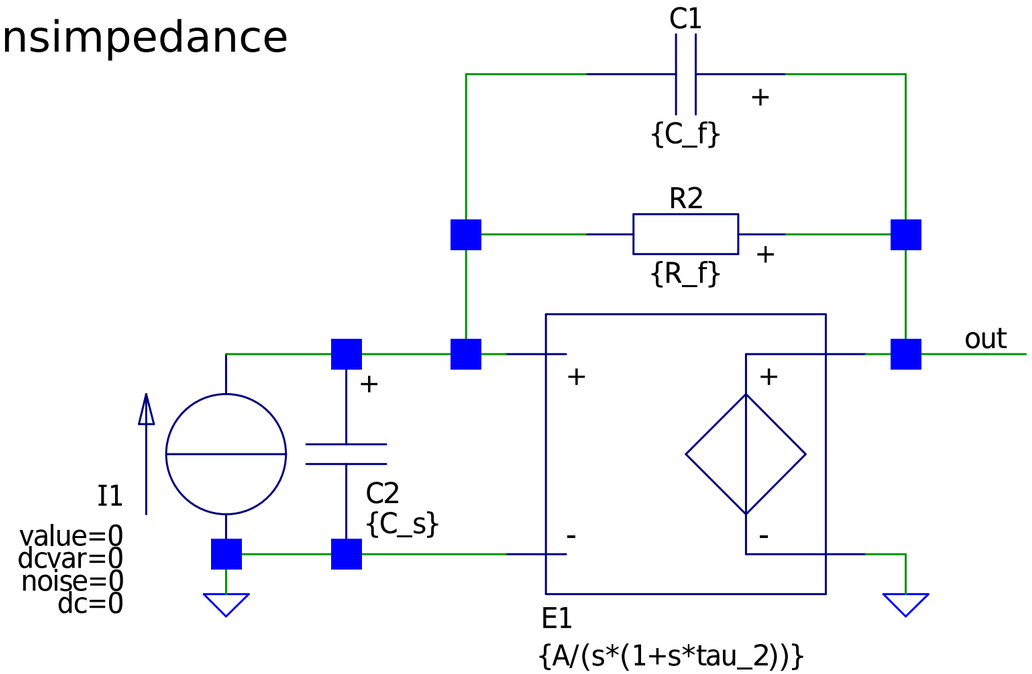

$$C_f > 50 \cdot 10^{-12}$$

$$\tau_2 = 0$$

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Phantom zero bandwidth limitation

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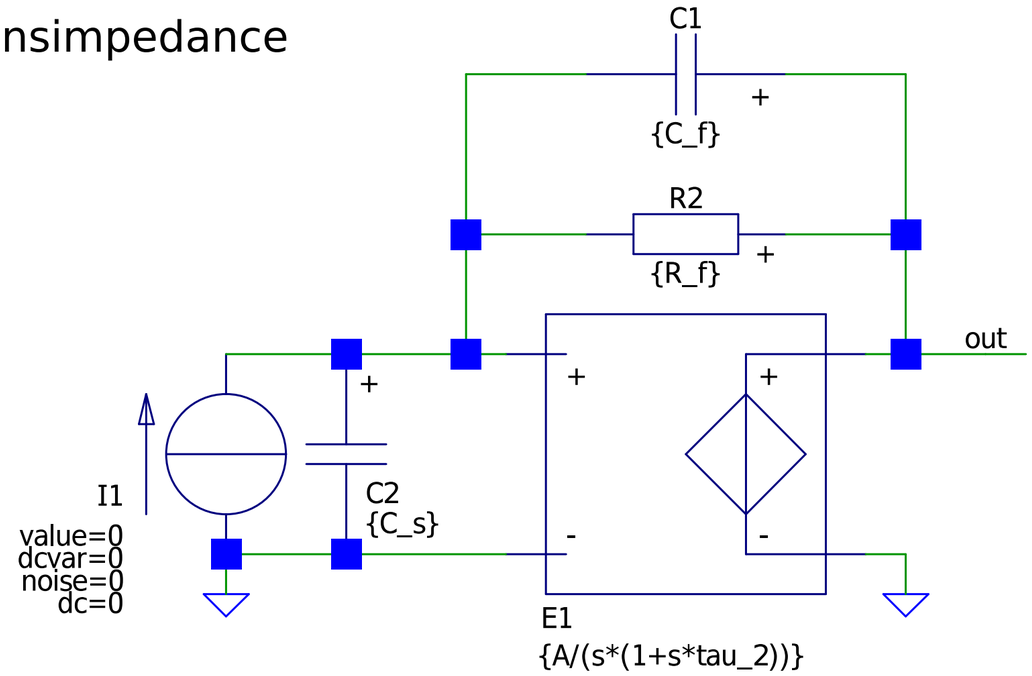

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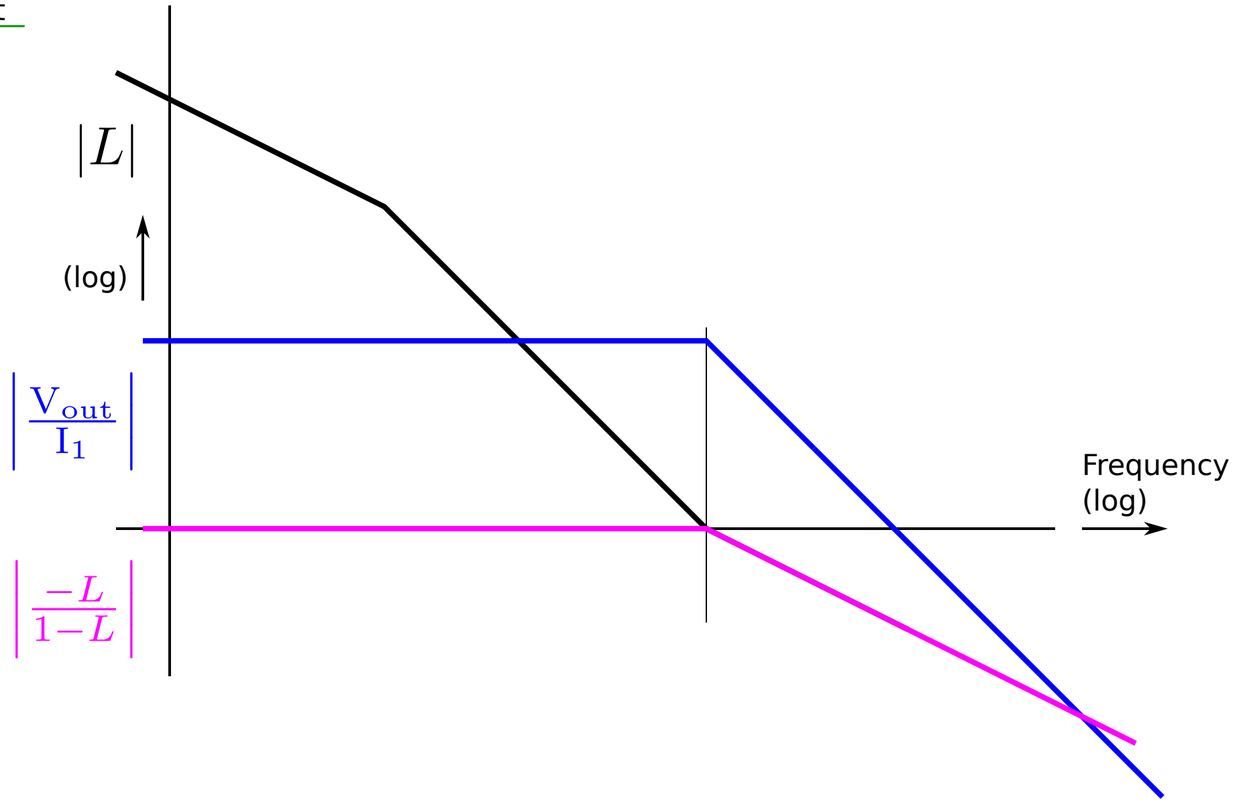

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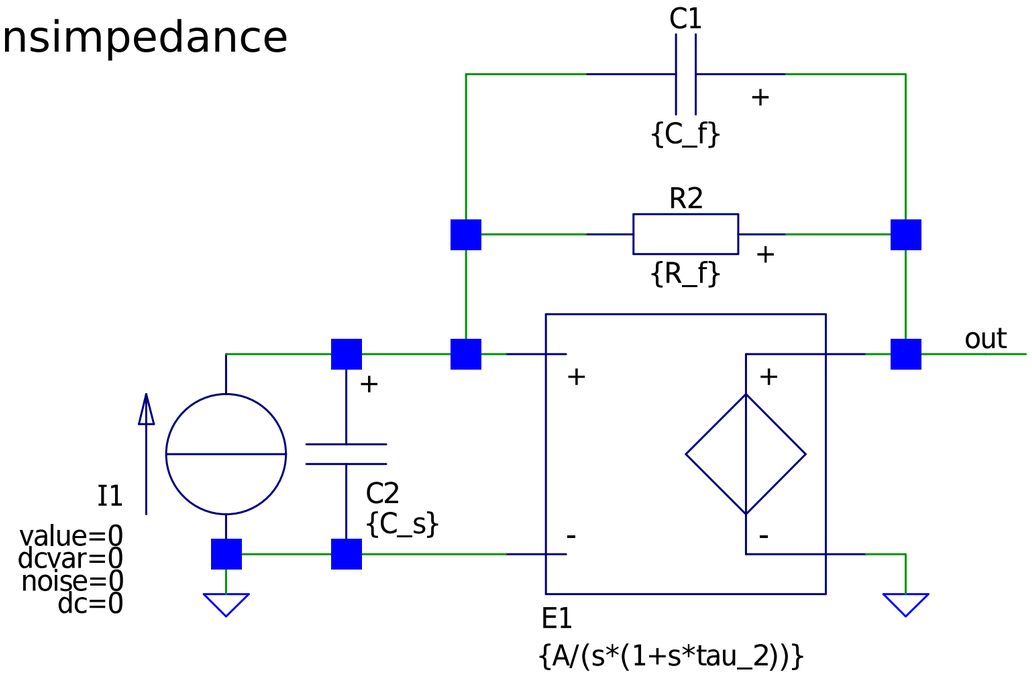

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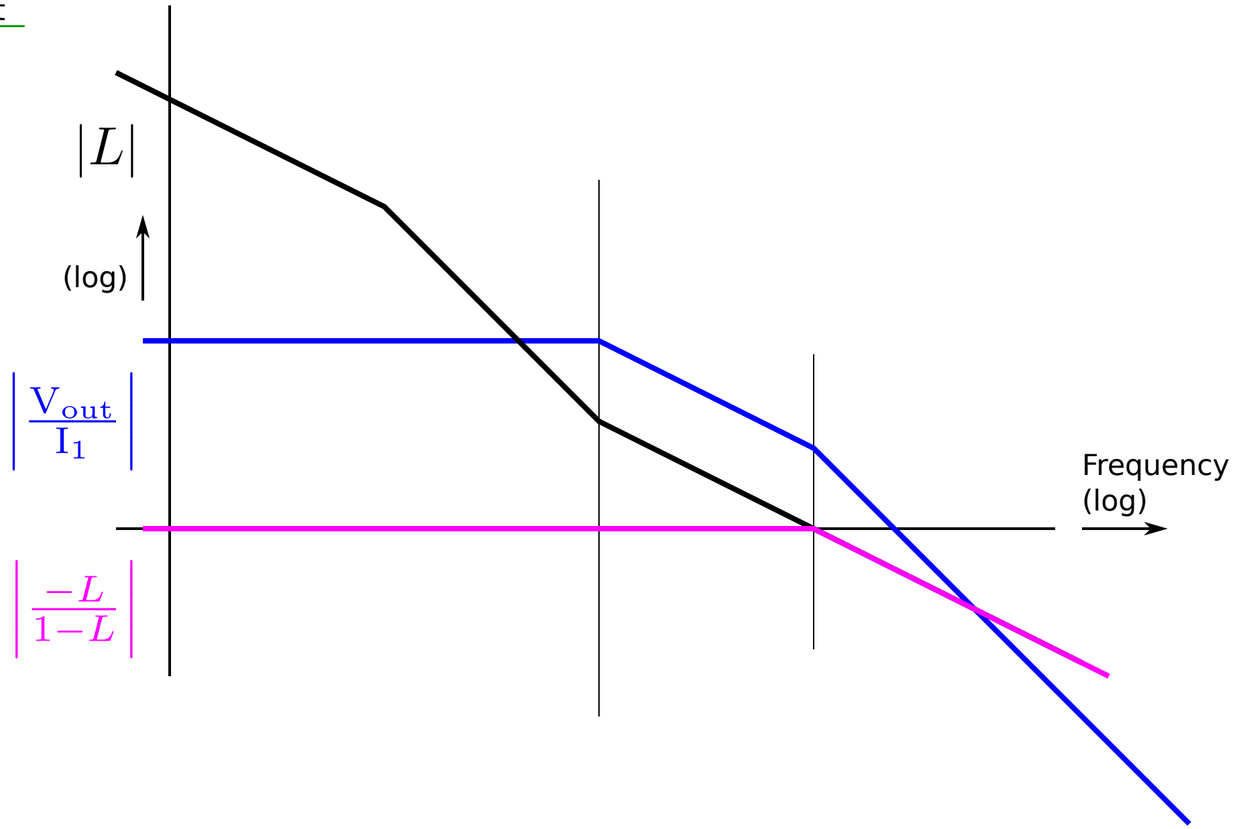

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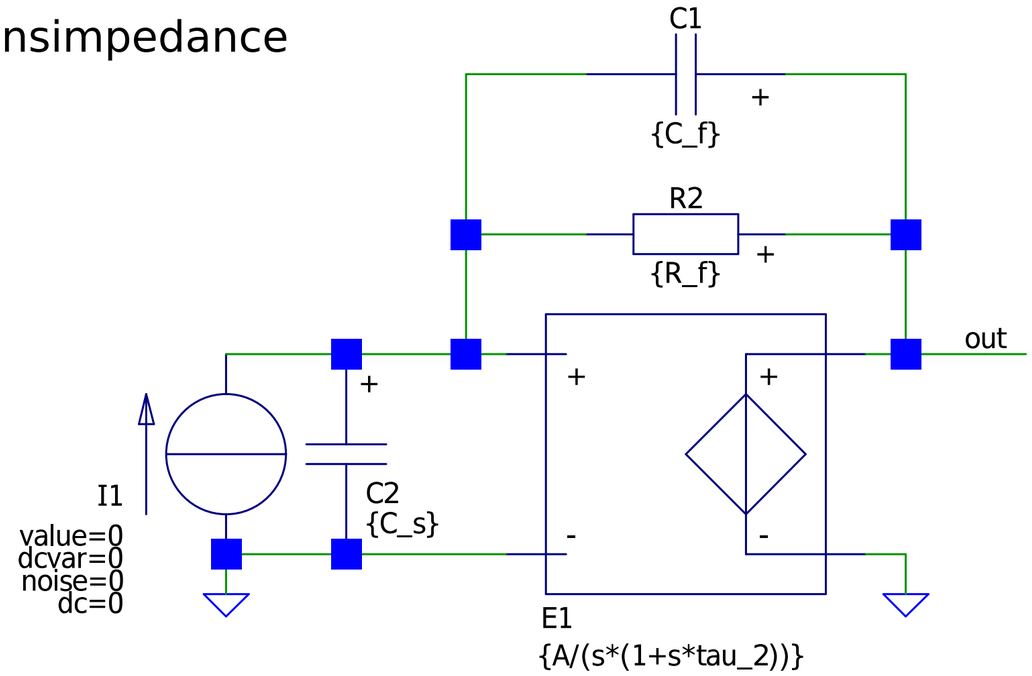

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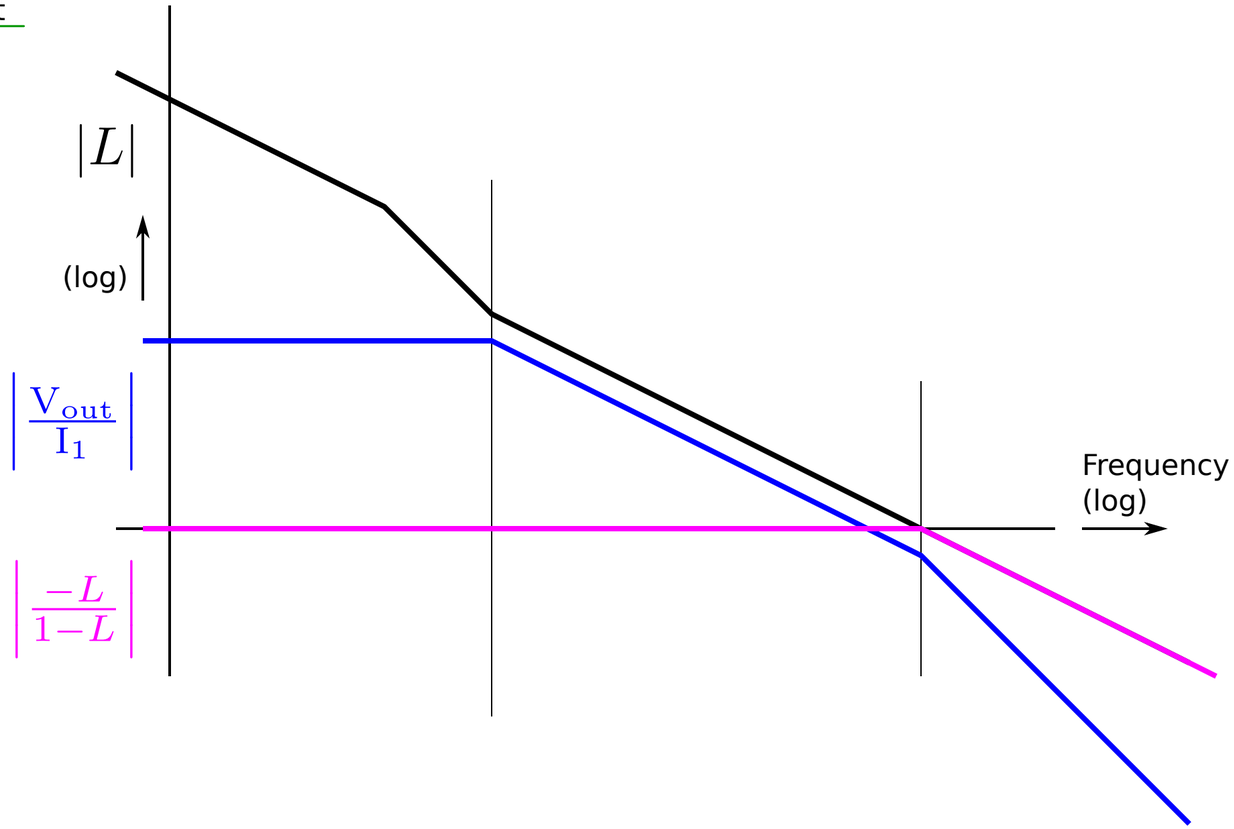

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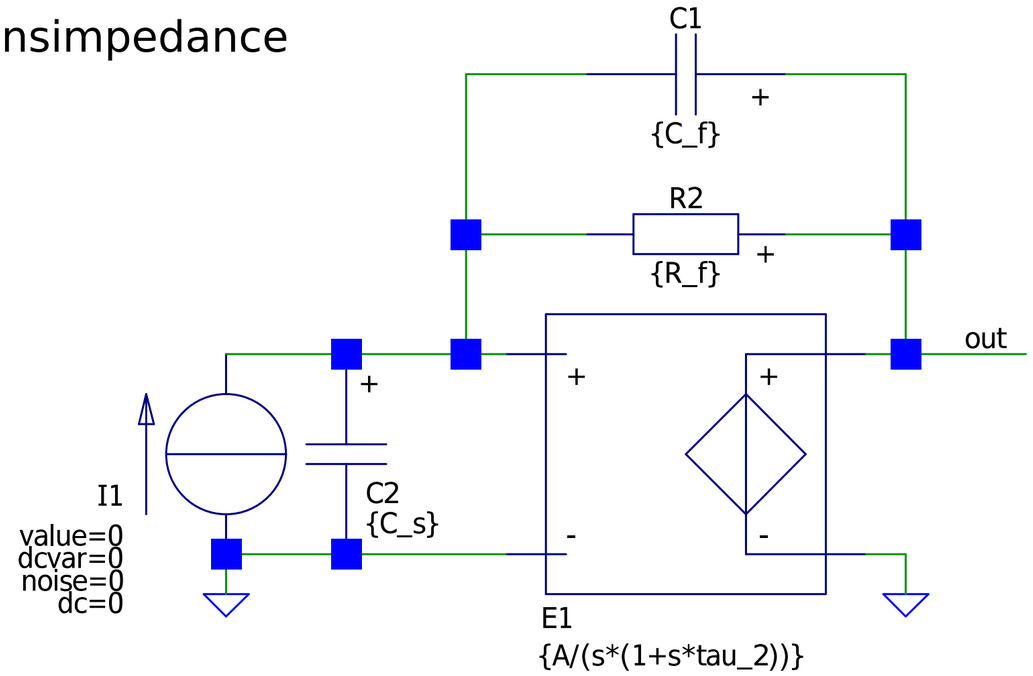

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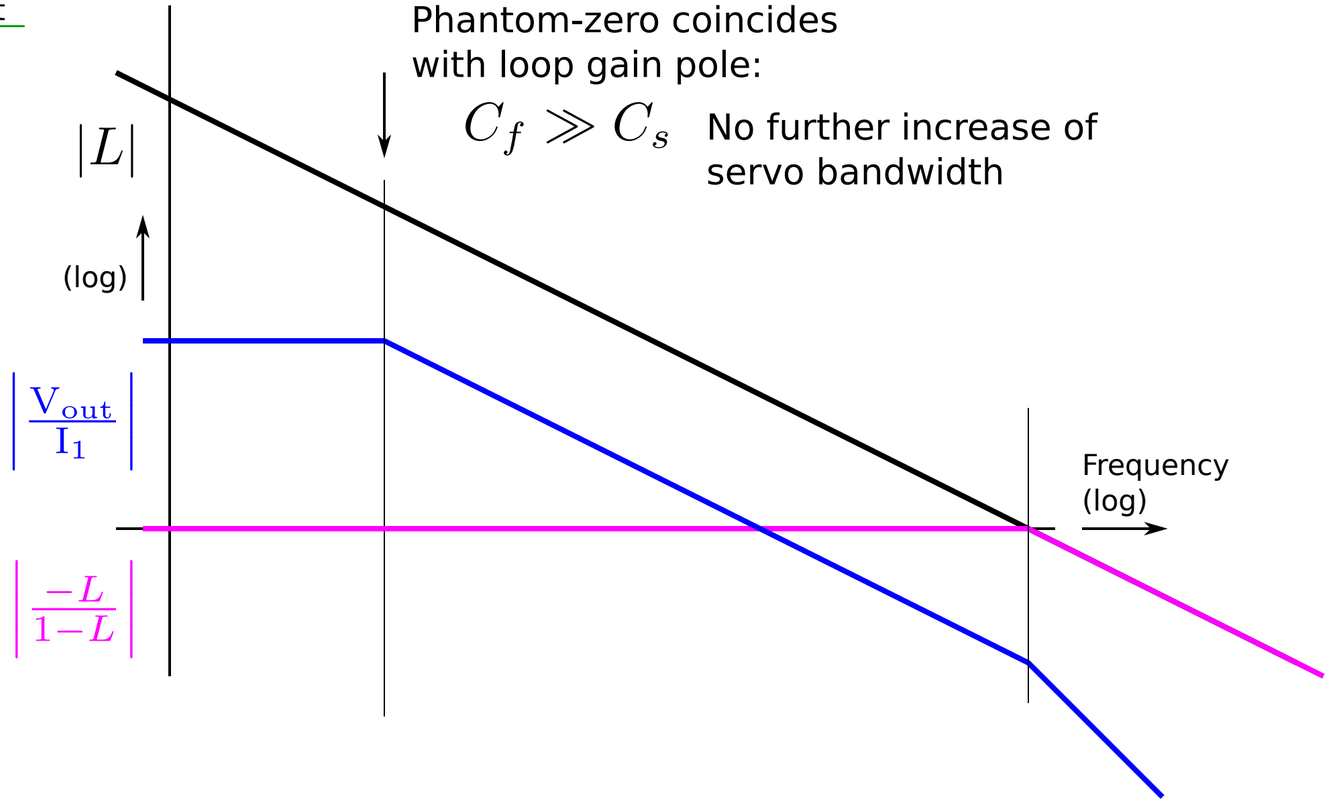

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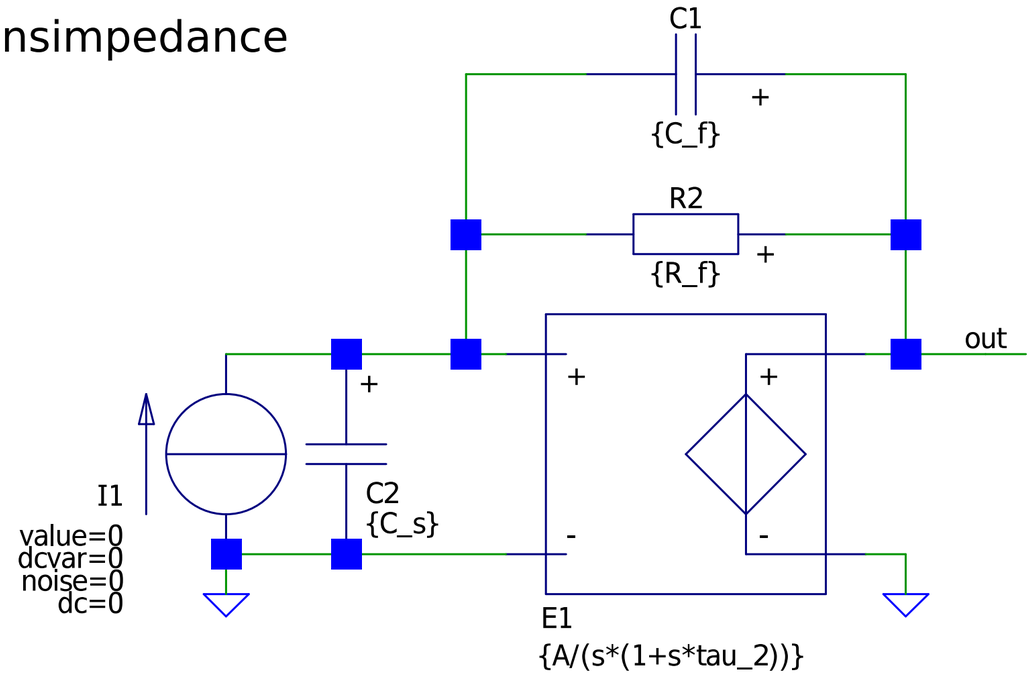

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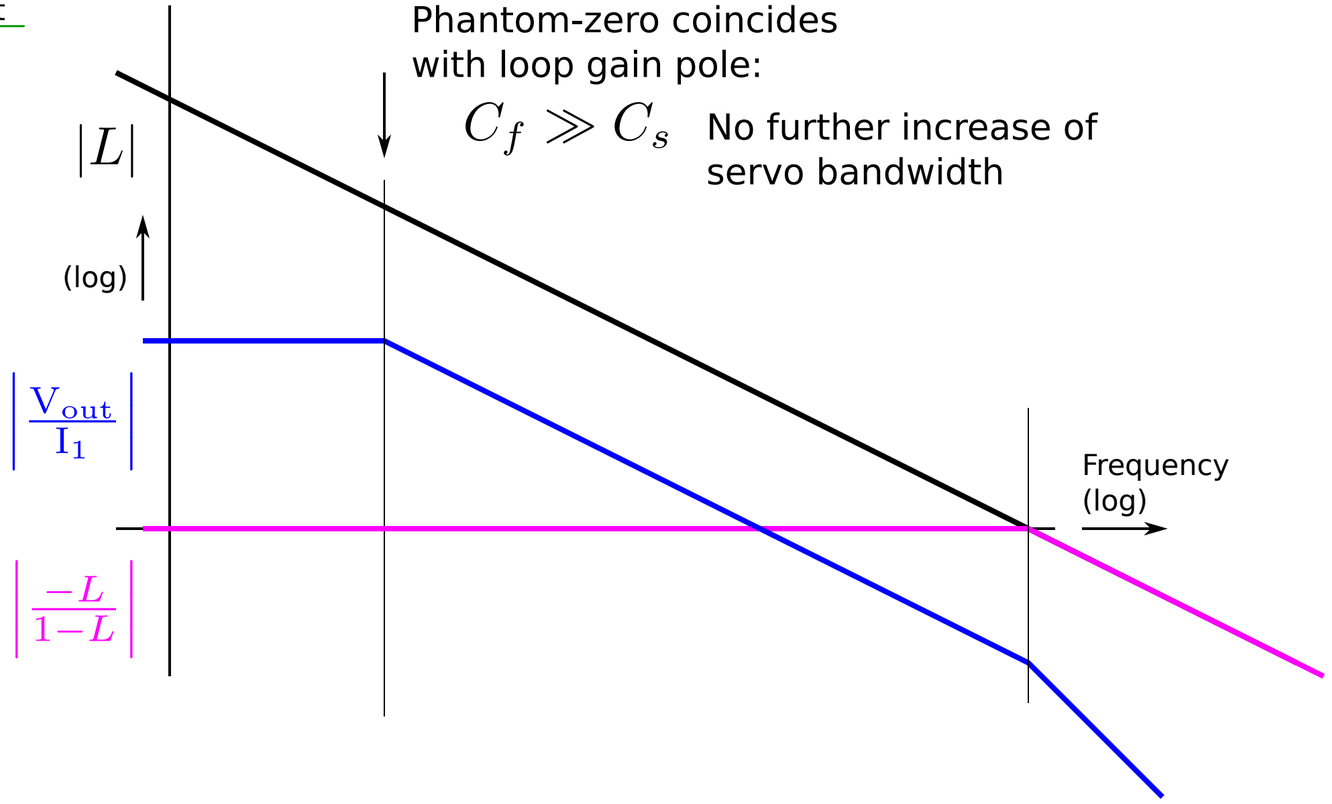

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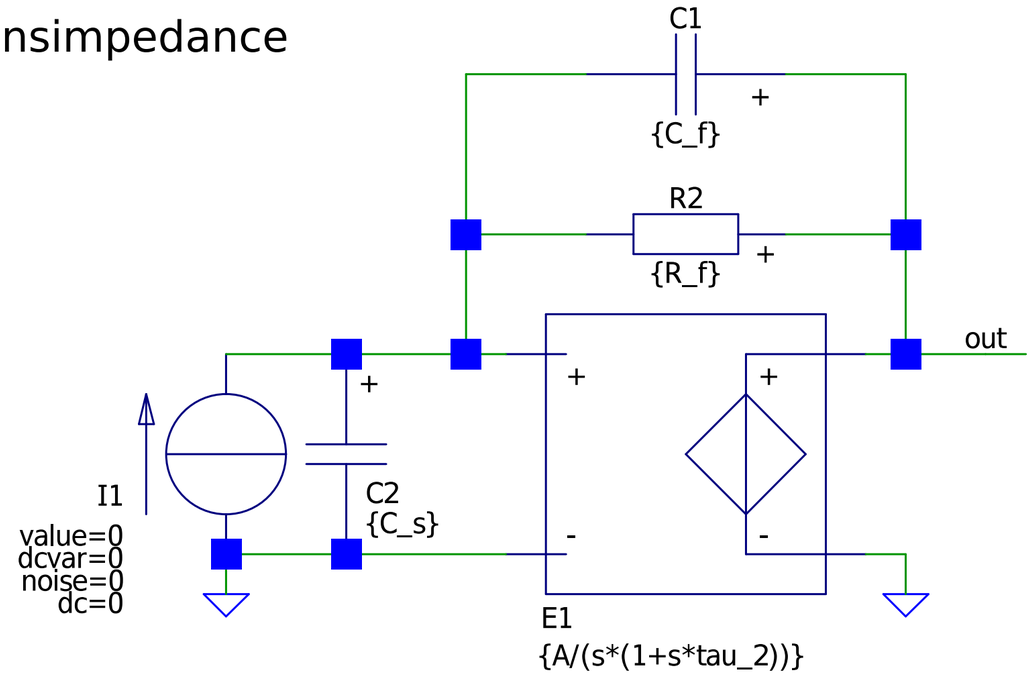

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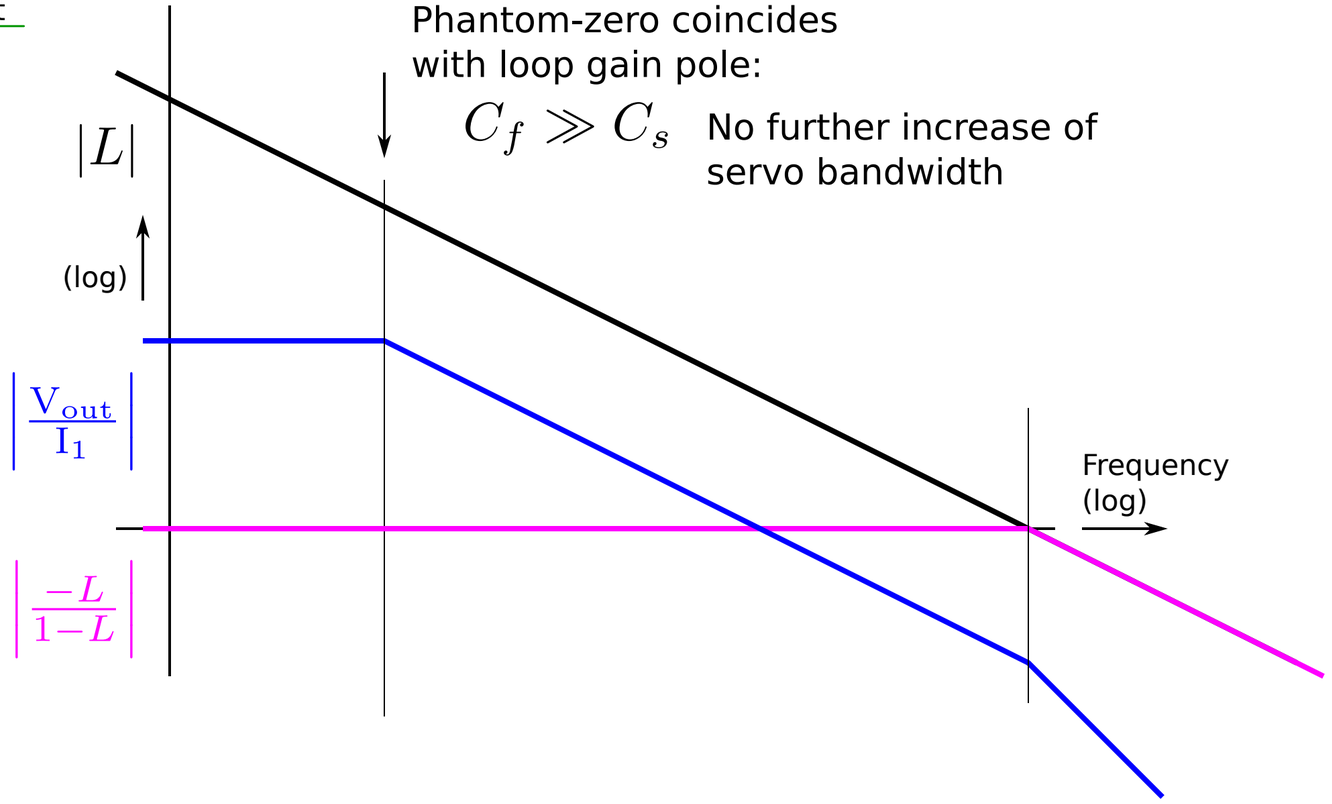

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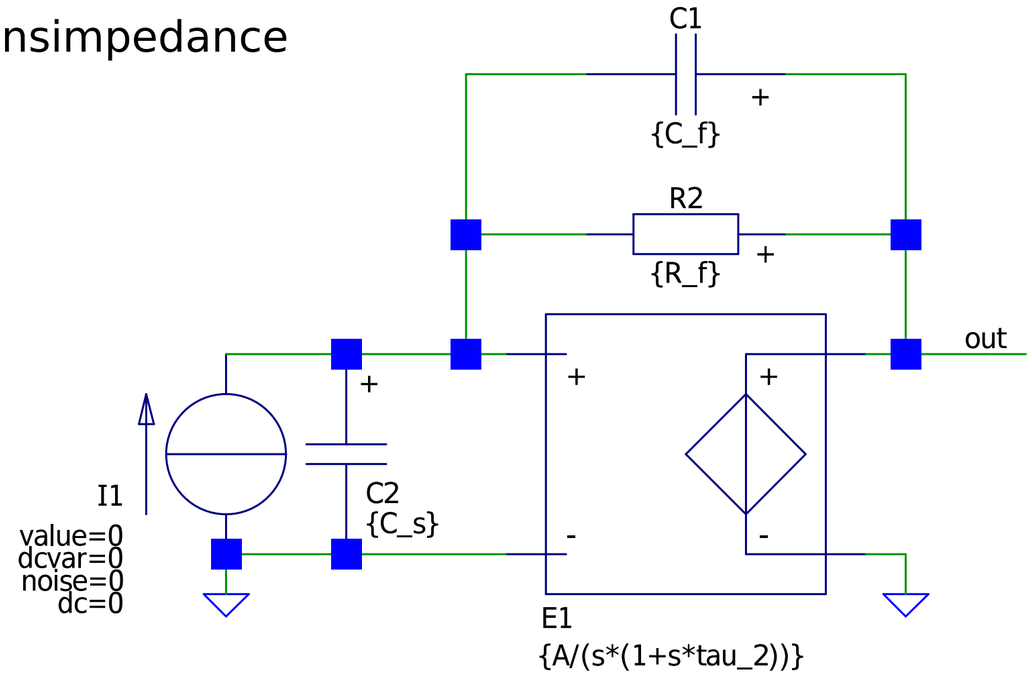

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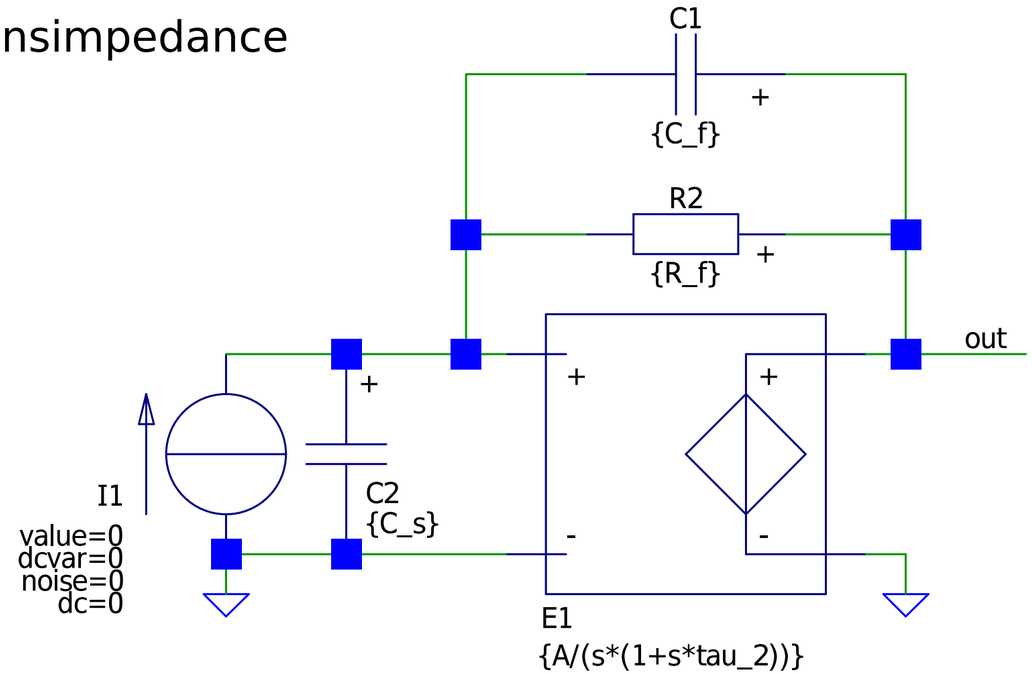

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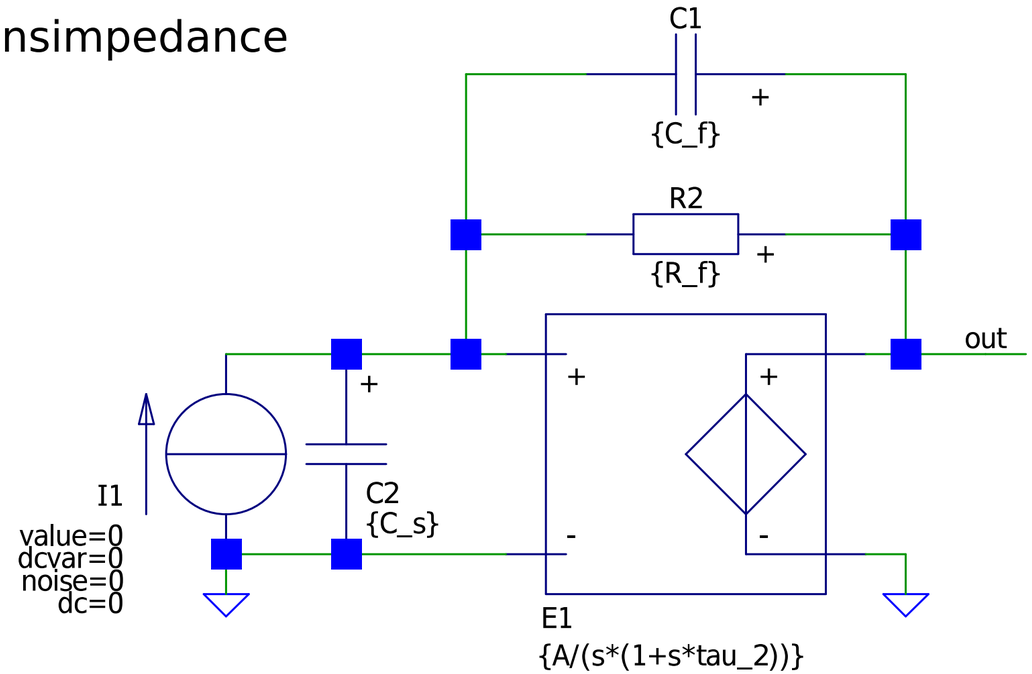

Non-dominant poles may become dominant

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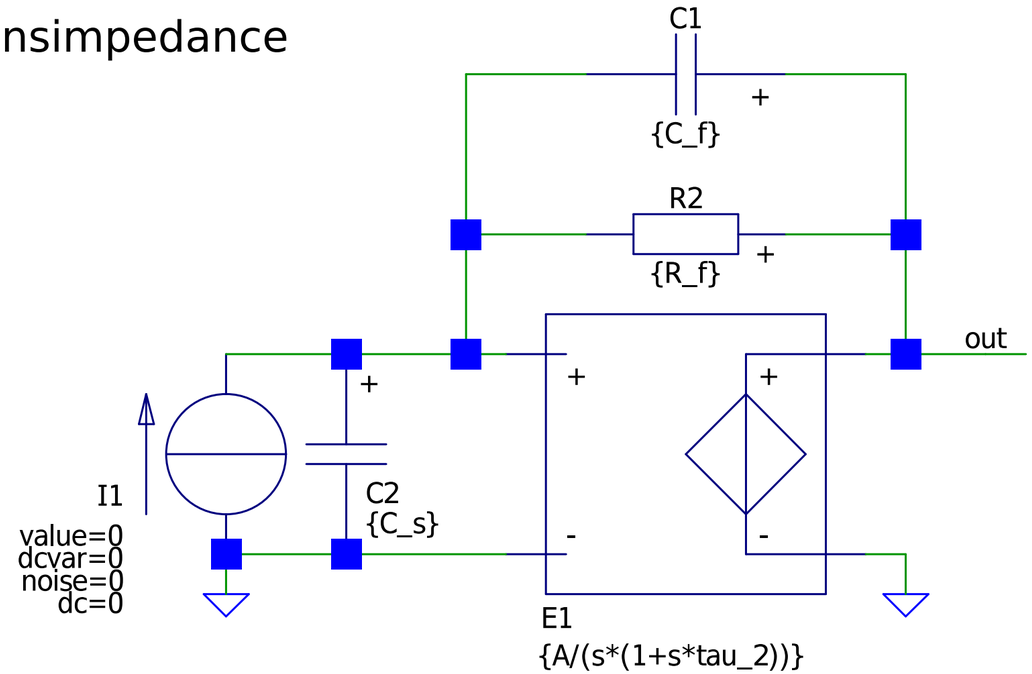

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Study effect in: PhZbwLimit.py

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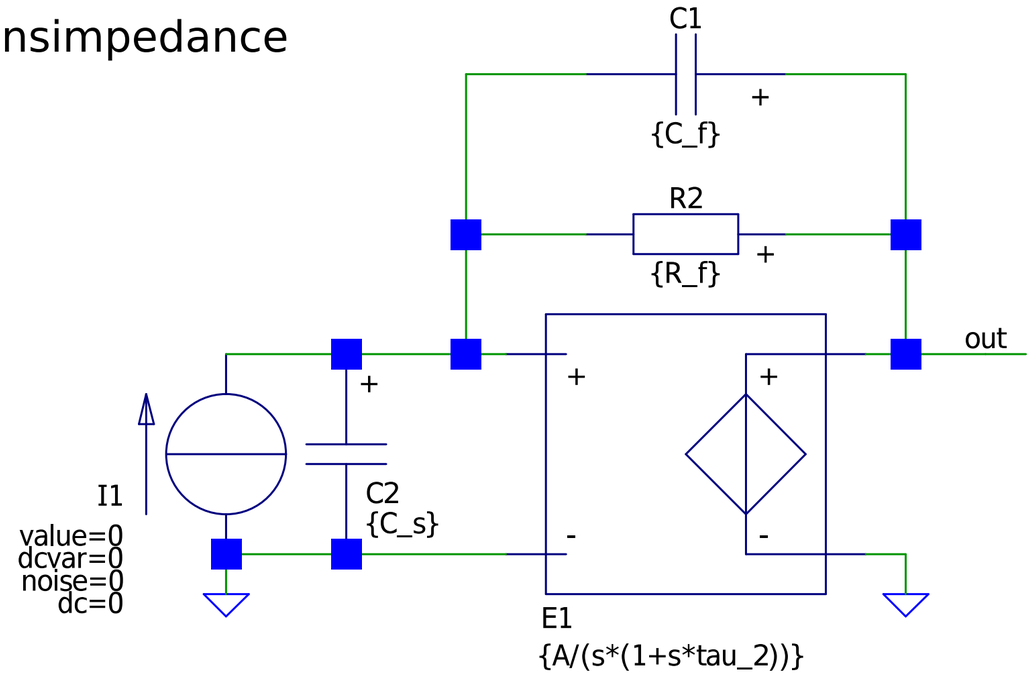

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