

Structured Electronic Design

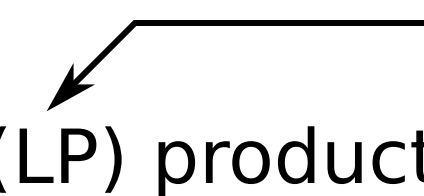
All-pole loop gain and servo bandwidth

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All-pole loop gain

$$A_f(s) = A_{f\infty}(s) \frac{-L(s)}{1-L(s)} \quad L(s) = \frac{L_{DC}}{\prod_{i=1}^n \left(1 - \frac{s}{p_i}\right)}$$

$$S(s) = \frac{-L(s)}{1-L(s)} = \frac{-L_{DC}}{\prod_{i=1}^n \left(1 - \frac{s}{p_i}\right) - L_{DC}} = \frac{-L_{DC}}{1-L_{DC}} \frac{1}{1 + \dots + \frac{(-s)^n}{(1-L_{DC}) \prod_{i=1}^n p_i}}$$



 loop gain-poles (LP) product

Denominator coefficient of highest order of s determined by loop gain-poles (LP) product

If all poles are dominant:

$$\omega_n = \sqrt[n]{|(1 - L_{DC}) \prod_{i=1}^n p_i|}$$

$$\omega_n = \sqrt[n]{|\mathbf{LP}_n|} \longleftarrow \text{n-th order LP product}$$