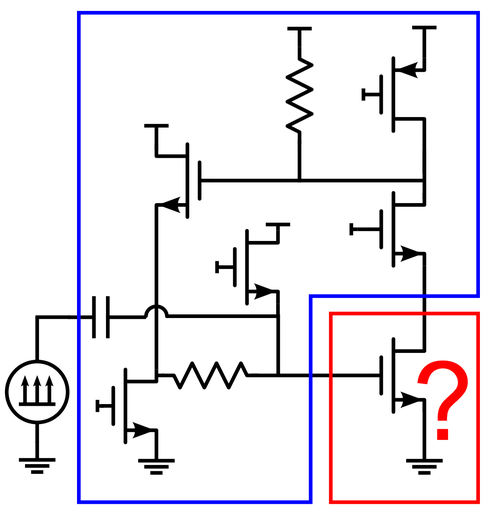
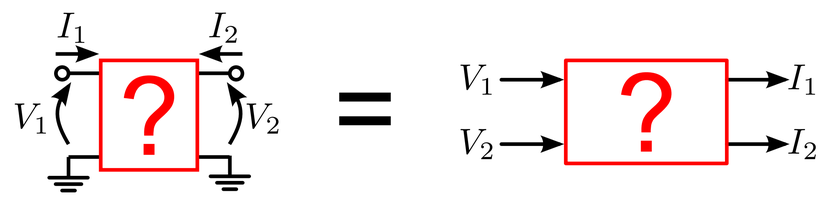
Estimating the Best Linear Approximation in simulations of electronic circuits

Adam Cooman, Piet Bronders and Gerd Vandersteen

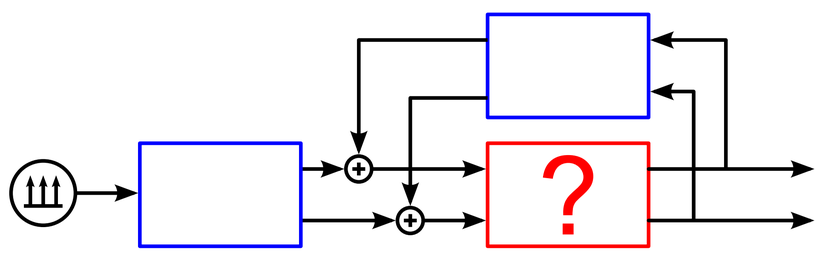


Goal:
Find the BLA

It will be a MIMO BLA:

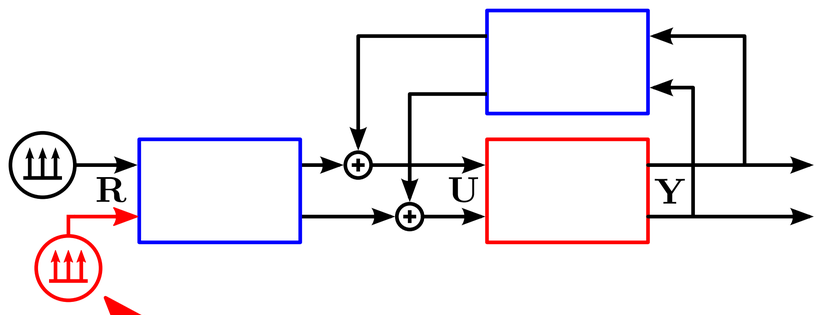


In a feedback configuration:

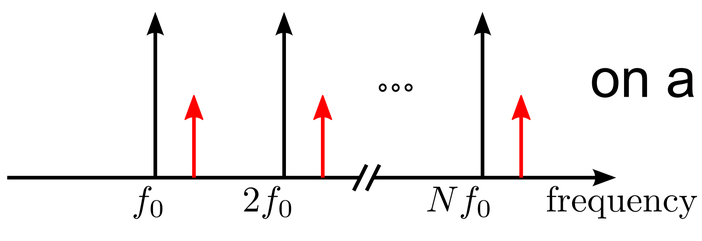


Classical approach

Well conditioned input matrix needed



Add very low amplitude (multi)sine



on a non-overlapping grid

Finally: use indirect method to determine the BLA

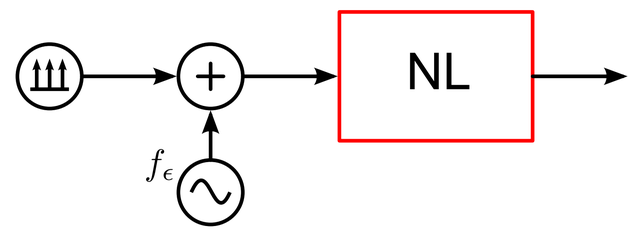
$$\mathbf{G}_{BLA}(f) = \left(\mathbb{E}\left[\mathbf{Y}^{[R]}(f)\right]\right) / \left(\mathbb{E}\left[\mathbf{U}^{[R]}(f)\right]\right)$$

👎 Longer simulation time

👎 Danger of changing the Non-linear operating point

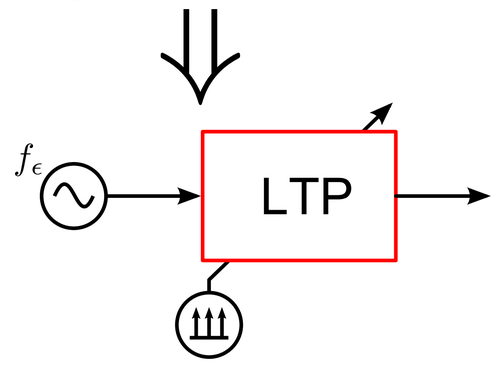
Linear Time Periodic approach

Linearise around periodic operating point...

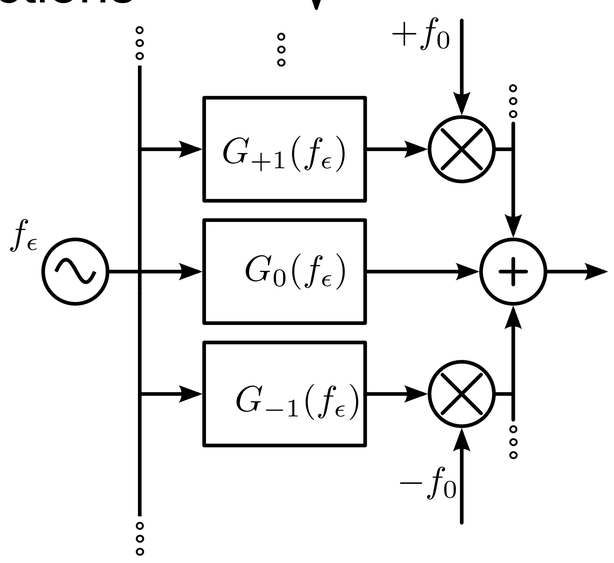


... to obtain the LTP response to the tickle tone

Can be obtained with
a Large-Signal Small-Signal simulation

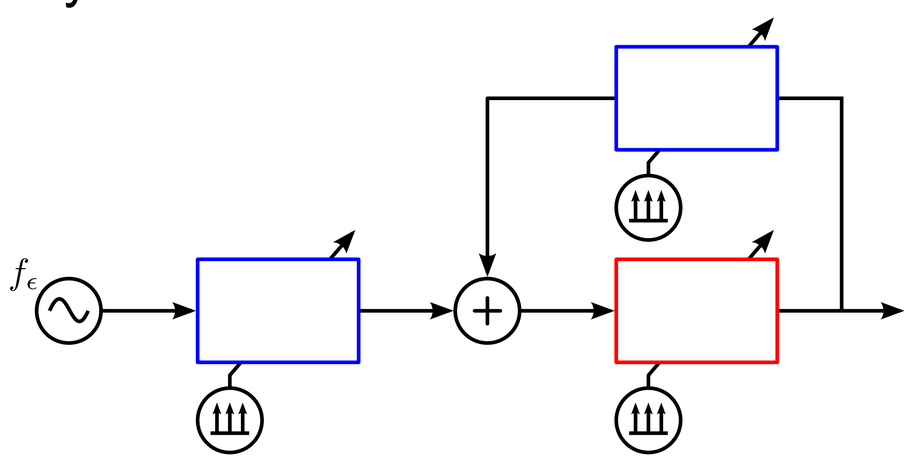


Harmonic Transfer Functions describe the behaviour of the LTP system



Theory guarantees the equivalence between $G_{BLA}(f_\epsilon)$ and $\mathbb{E}[G_0(f_\epsilon)]$

LTP system in feedback:



!!! Computation of G_0 depends on all $f_\epsilon \pm kf_0$

Linearisation around periodic operating point

👍 No influence on NL. operating point

Contributions to G_0 are smooth over f_ϵ

👍 Less realisations of the multisine needed

Single-tone excitation

👍 Easily extended towards out-of-band BLA

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