

Finding the dominant source of distortion by combining the BLA and MIMO noise analysis

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To be able to cope with ever stronger specifications in terms of linearity, designers of analog electronic circuits need tools to effectively reduce the distortion generated in their circuits. A first step in solving a problem is finding its source, so our goal is to develop a simulation-based method which shows the dominant sources of non-linear distortion in an electronic circuit. To be useful during the design stage, the analysis should be fast and should avoid the use of special simulation techniques and/or device models.

We combine the Best Linear Approximation (BLA) with existing noise analysis techniques to obtain our goal. The BLA allows to consider the distortion added by every stage as noise. Combining the BLA with a noise analysis allows to pinpoint the dominant source of non-linear distortion.

Last year at ERNSI, we presented how this BLA-based noise analysis could be used to determine the dominant source of distortion in a two-stage operational amplifier. The method relied on the assumption that each stage can be described with a single-input single-output BLA.

At high frequencies, the input impedance and reverse gain of amplifier stages play an important role. Taking these effects into account requires a port representation of the stages and the interconnection network. This leads to the improved MIMO BLA-based noise analysis, which can be used hierarchically from the system level, down to the transistor level.