Regular paper

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Abstract

Several frequency compensation schemes have been proposed to stabilize multistage amplifiers with negative feedback. The performance of these amplifiers can be analyzed by inspecting their input-output transfer function as representation of frequency response. With many circuit elements affecting the output response, it is relatively difficult to obtain the real transfer function of multistage amplifiers based on original small-signal expressions only. Instead, certain techniques such as Miller's theorem are used to approximate important parameters such as DC gain and dominant pole. These methods are not generally helpful for approximating nondominant poles with critical role on loop stability of nano-scale amplifiers. With this issue in mind, this work proposes a systematic methodology to achieve the pole expressions of multistage amplifiers with frequency compensation. The key in the proposed technique is to obtain the equivalent impedance of the compensation loop at the output of the amplifier. The effectiveness of the proposed approach has been verified through comparison between the transfer functions obtained from theory and those transfer functions found in the literature.

Index Terms: Amplifier, cascode compensation, compensation capacitor, cross-feedforward cascode compensation, frequency compensation, Miller compensation, nested-Miller compensation, operational amplifier (opamp), poles and zeros, single-Miller capacitor frequency compensation, stability, and transfer function.