Abstracts

A Systematic Optimization Strategy for Microwave Device Modelling

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Small signal GaAs MESFET equivalent circuit models are typically very ill-conditioned since the error function most often used is sensitive to some combinations of the model components and extremely insensitive to other combinations. Consequently the convergence of the parameter estimation routines used is slow and there is a good deal of uncertainty associated with the optimized values of the insensitive components. In this work the degree of ill-conditioning in the equivalent circuit model is formally quantified using a systematically formulated principal components sensitivity analysis procedure. Using this procedure it is possible to estimate for the first time how reliable the component values are in the optimized model. On this basis the extraction of the MESFET equivalent circuit model is compared using electrical model components and physical model parameters. In addition a new optimization strategy is presented which improves the condition number of the model so that rapid convergence and accurate models are ensured. This technique transforms the axes of the model from the equivalent circuit components which are correlated to the uncorrelated principal component axes which can be systematically scaled to eliminate ill-conditioning. Using this technique it is possible to obtain accurate estimates of the insensitive model parameters such as the parasitic resistances without resorting to direct measurement techniques.

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