Final Year Project (2003-04) Poster

Project Title: 0.18-µm CMOS RF Characterization and Modeling
Project ID: CKJ2-03
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Nowadays computer simulation is essential for all kinds of integrated-circuit design. Circuit designers use their CAD (Computer Aided Design) tools to predict the performance of their designs. A simulation process requires two main inputs: circuit schematics and device models. The circuit schematic informs the computer about the connections and circuit parameters while the device models provide descriptions and parameters of the physical devices. Thus, the accuracy of the simulation depends on the preciseness of these parameters.

The model parameters are derived from measurements and from the characterization of the devices. However, at Radio Frequency, the accuracy of the measurements and characterization is degraded as inevitable capacitance and inductive with values in the Device Under Test (DUT). Also, due to the fact the performance of the CMOS is totally different in small-signal and large-signal applications, device characterization and modeling in the RF range is a challenging task and it is difficult to accurately describe the device behavior.

The aim of this project is to characterize a 0.18µm CMOS transistor by Advance Design System together with modeling of the transistor by Matlab 6.5.

The above figure shows the small-signal model of a CMOS transistor.
Extraction of small signal parameters and compare the results of different methods

Device de-embedding (by making use of S-, Y-, Z- parameter)

Open Pad De-embedding
Open/Short De-embedding
Open/Short/Thru De-Embedding
3-step De-embedding

Export the set of small signal parameters to Matlab for modeling

↑ 3-D graph showing $g_m$ of n200 after de-embedding

Results
↑ 3-D graph showing $C_{gs}$ of n200 after de-embedding

↑ 3-D graph showing $C_{gd}$ of n200 after de-embedding

↑ 3-D graph showing $C_{ds}$ of n200 after de-embedding

↑ 3-D graph showing $r_{ds}$ of n200 after de-embedding