Friedrich-Alexander-Universität Technische Fakultät Lehrstuhl für Technische Elektronik





Design-flow approaches for mmWave and sub-THz integrated transceiver circuits for radar and communication From a design tools user perspective

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Our Designs and Design Flows



Chip design lab course





Lab course – Getting started

- HBTs, Resistors, Capacitors..
- Transmission Lines
 - PDK models
 - Cadence rfTlineLib
- Inductors and Transformers
 - Ideal Components with Q factor
 - EM Simulated Structures
- Testbench
 - Sources, ideal balun, ...



Lab course - Simulation

- S-parameter / Z-parameter simulation
 - Differential mode, common mode, ...
 - Noise simulation
- Harmonic Balance / Periodic steady state
 - Noise simulation
 - Large signal S-parameter
 - Intermodulation
- Transient simulation

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Layout – Core Cells



- Small cell with Transistors, Vias, Crossings, ...
- Layout with Transmission line interfaces
- Parasitic Extraction (C, RC)
- Annotation in schematic



Layout – Passive Components

- Transmission lines, inductors, transformers, Lange coupler, Baluns, slow wave lines, ...
- Testbenches e.g. for inductance and quality factor extraction
- S-parameter best to be saved in design library
- Coupling effects of multiple passive components
- Speeding up the cycle:
 - 1. Saved simulation settings, automatic pin adjustment
 - 2. Parametric models
 - 3. Automated EM simulation





Layout – Passive Components

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Layout – Passives - cdsTECL

Automated simulation of typical passive components



Design-flow approaches for mmWave and sub-THz integrated transceiver circuits for radar and communication

Auxiliary circuits



- Bandgap reference, current mirrors, DACs for biasing
 - Substrate PNPs, Mosfets
 - Monte Carlo Simulation
- Digital Designs
 - Synthesized from VHDL with Cadence Genus / Innovus with IHP stdcell library
 - Mixed signal simulation

Library Management



OpenAccess Database

- Hierarchically stored data
- Cells / Directorys with different views: schematic, layout, s-parameter, vhdl, ...

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Summary - Helpful resources



	Lab course	Thesis	Ph.D. students
Setup manual / Training videos	++	++	++
Simulation	sp, hb/pss with sp, transient	sp, hb/pss with sp, transient, pss for oscillator, (PVT)	sp, hb/pss with sp, transient, pss for oscillator, PVT
Simulation models	HBT, t-lines	HBT, t-lines, inductors, capacitors, Mosfets	HBT, t-lines, inductors, capacitors, Mosfets, transformers
Layout	Only visualization	Pcells, DRC, LVS, PEX	Pcells, DRC, LVS, PEX, Pads
Digital flow	0	0	++
EM simulation	0	+	++