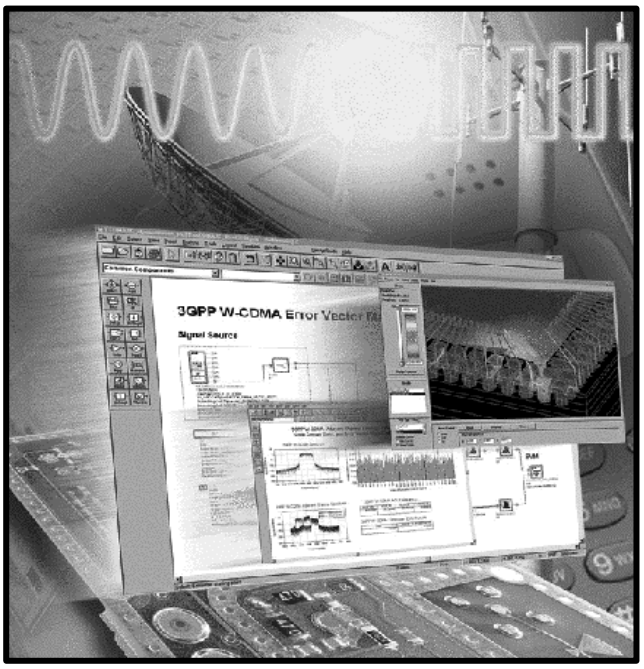
Training Course Workbook

Advanced Design System

ADS 2003
Fundamentals



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Agilent EEsof EDA - Customer Education

Santa Rosa, California USA

ADS 2003 Fundamentals

Contents: Slides and Lab Exercises

TOPICS (tab sections)

1: Circuit Simulation Fundamentals
2: System Simulation Fundamentals
3: DC Simulation and Circuit Modeling
4: AC Simulation and Tuning
5: S-Parameter Simulation and Optimization
6: Filters: Transient, DesignGuide, Momentum, DAC
7: Harmonic Balance Simulation
8: Circuit Envelope Simulation
9: Final Circuit / System Simulation (Ptolemy)

Appendix: additional material on simulators and examples

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LAB 1: Circuit Simulation Fundamentals

Overview - This lab covers user interface basics, ADS files, schematic capture, simulation, and data display. In addition, tuning and ADS example files are also covered.

OBJECTIVES

- Create a new project and schematic designs
- Setup and perform S-parameter simulation
- Display simulation data and save files
- Tune circuit parameters during simulation
- Use the Examples files and node names
- Perform a Harmonic Balance simulation
- Write an equation in the data display

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LAB 2: System Design Fundamentals

Overview - This chapter introduces the use of behavioral models to create a system such as a receiver. This lab will be the first step in the design process where the system level behavioral models are simulated to approximate the desired performance. By setting the desired specifications in the system components, you can later replace them with individual circuits and compare the results to the behavioral models.

OBJECTIVES

- Use the skills developed in the first lab exercise.
- Create a system project for an RF receiver using behavioral models (filter, amplifier, mixer) where: RF = 1900 MHz and IF= 100 MHz.
- Use an RF source, LO with phase noise, and a Noise Controller.
- Test the system: S-parameters , Spectrum, Noise, etc.

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LAB 3: DC Simulations and Circuit Modeling

Overview - This chapter introduces parametric subnetworks: how to create and use them in hierarchical designs. Beginning with a device model, the lowest level subnetwork will also contain packaging parasitics to better model the device behavior. Also, a test template will be used to simulate curve tracer responses from which a bias network can be computed, built, and checked. The circuit in this lab exercise will be the foundation of the amplifier that will be used for the other lab exercises in this course.

OBJECTIVES

- Model a generic BJT with parasitics and save it as a sub circuit.
- Set up and run numerous DC simulations to determine performance.
- Calculate bias resistor values in the data display.
- Build a biased network based on the DC simulations.
- Test the biased network.

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LAB 4: AC Simulations

Overview - This lab continues the amp_1900 project and uses the same sub-circuit as the previous lab. This exercise teaches the basics of AC simulation, including small signal gain and noise. It also shows many detailed features of the data display for controlling and manipulating data.

OBJECTIVES

- Perform AC small signal and noise simulations.
- Adjust pin/wire labels.
- Sweep variables and write equations.
- Control plots, traces, datasets, and AC sources.

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LAB 5: S-parameter Simulation and Optimization

Overview - This exercise continues the amp_1900 design. It teaches how to setup, run, optimize and plot the results of various S-parameter simulations. Also, the optimizer is used to create the impedance matching networks.

OBJECTIVES

- Measure gain and impedance.
- Set up and use sweep plans, parameter sweeps, and equation based impedance.
- Calculate values for a matching network.
- Tune a matching network.
- Use optimization to meet design goals.
- Use Noise and Gain circles.

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LAB 6: Filters: Design Guide, Transient, and Momentum Simulation

Overview - This chapter shows the fundamentals of creating filters in ADS and using the Transient simulator. The Design Guide is used to build a lumped component filter and Momentum is used to test a microstrip filter.

OBJECTIVES

- Build a 200 MHz IF low pass lumped filter using a DesignGuide
- Build a 1900 MHz RF bandpass filter in microstrip.
- Perform a Transient analysis on the microstrip filter.
- Simulate the microstrip filter in Momentum.
- OPTIONAL –DAC (data access component) exercise.

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LAB 7: Harmonic Balance Simulations

Overview - This exercise continues the amp_1900 design and shows the fundamentals of using the Harmonic Balance simulator to look at the spectrum, analyze compression, calculate TOI, and perform other non-linear measurements.

OBJECTIVES

- Set up and perform a 1 tone HB simulation.
- Set up and perform a 2 tone HB simulation.
- Use variables for simulation and source control.
- Test Gain, Compression, Available Power, Noise Figure, IP3, and other specifications.
- Use the *ts* transform on HB data.
- Work with equations, plots, and the Mix table.

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LAB 8: Circuit Envelope Simulation

Overview - This chapter covers the basics of Circuit Envelope simulation to simulate time and frequency of an output signal when the input is a pulsed or modulated source such as GSM, CDMA, etc.

OBJECTIVES

- Set up Circuit Envelope simulations using a behavioral amp
- Experiment with simulation parameters
- Test for distortion
- Use demodulation components and equations
- Simulate the 1900 MHz amp with a GSM signal
- Plot carrier and baseband data
- Operate on datasets in the frequency and time domain

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LAB 9: Final System and Circuit Simulations

Overview – This last lab exercise brings together all the circuits built during the course: the amplifier and filters. They replace the behavioral system models used in the earlier exercise.

OBJECTIVES

- Create a sub-circuit for the 1900 MHz amplifier for use in the system.
- Use the Smart Simulation Wizard.
- Set up and run simulation a HB simulation with a GSM source.
- Set up and run a CE simulation using a CDMA source.
- Simulate ACPR and power specs using an example data display.
- Program Marker sliders to customize data displays.
- OPTIONAL - Co-simulations with minimal instructions.

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