

Integrated Antennas, MEMS, & RFICs

Integration of antennas with active and passive microwave devices results in self-contained radio frequency (RF) systems. ESL research is developing new integrated systems, as well as reconfigurable integrated antennas, coupled oscillator technologies, and components for RF integrated circuits (RFICs).

RF MEMS Switches

A recent project is focused on the design and development of RF Micro ElectroMechanical Switches (MEMS). The successful integration of these low loss miniature switches into RF systems, including systems-on-a-chip, implies an integrated design that accounts for electrical, thermal, and mechanical interactions.

Active Integrated Array Antennas

Current research on active integrated arrays focuses on arrays whose elements combine the radiator and the oscillator. Nonlinear phenomena are used to generate phase variations to scan antenna beams, and analysis/design is performed via a combination of full wave electromagnetic solvers and CAD-based nonlinear circuit solvers.

Integrated Circuit Electromagnetic Analysis and Design

The past two decades have brought a revolution in “wireless” communications. One of the key reasons for this rapid change is the development of integrated circuits (ICs) and systems, especially deep sub-micron CMOS technology. To achieve this level of integration, enormous challenges must be overcome, including the design of RF, analog, and digital circuits, and the interfaces among them. Electromagnetic phenomena such as mutual coupling, delays, eddy currents, substrate losses, etc. can degrade the performance of the circuits. It is also difficult to design integrated inductors due to their large size and low Q factors. We are currently developing lumped circuit models for inductors and capacitors, and are improving de-embedding schemes for “large size” inductors. We are also carrying out modeling techniques for integrated circuits such as filters, amplifiers, etc. Current work includes the acquisition of testing equipment for the complete characterization of a system on a chip.