NEXT GENERATION OPTIMIZATION METHODOLOGIES FOR WIRELESS AND MICROWAVE CIRCUIT DESIGN

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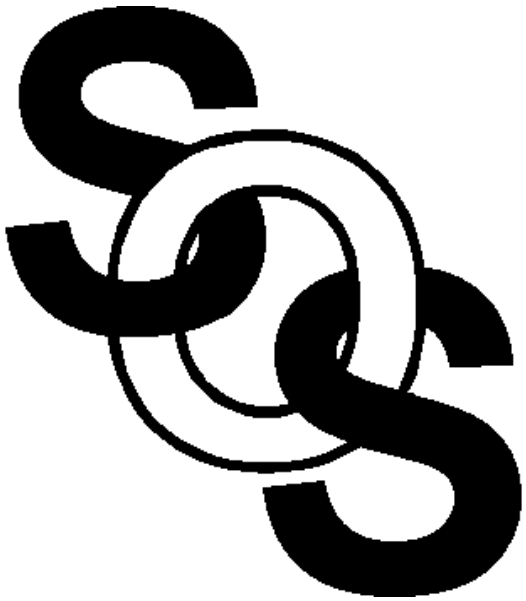
Simulation Optimization Systems Research Laboratory
and Department of Electrical and Computer Engineering
McMaster University, Hamilton, Canada L8S 4L7

bandler@mcmaster.ca
soya.sos.mcmaster.ca



NSERC Strategic Project

research area: information technology

Next Generation Optimization Methodologies for Wireless and Microwave Circuit Design

design automation, computer-aided design (CAD), electromagnetic field simulation, microwave circuits, RF circuits, wireless circuits, optimization, design for manufacturability

amounts awarded

Year 1	Year 2	Year 3
1997-1998	1998-1999	1999-2000
$97,343	$105,100	$107,400

Abstract

direct exploitation of electromagnetic (EM) simulators in optimization of high-frequency analog and high-speed digital integrated circuits is crucial for first-pass success CAD

EM field simulators offer higher accuracy, handle arbitrary geometrical shapes, are valid to millimetre-wave frequencies

significantly advance the state-of-the-art in automated EM-based design

develop theory and algorithms relevant to optimization methodologies for wireless and microwave circuit design

interface a variety of EM simulators with optimizers for seamless and concurrent interaction

address decomposition, EM couplings, higher-order modes, availability and features of EM software

make distributed quantities (fields, currents, radiation patterns) available for optimization

work on efficient, robust algorithms for EM optimization, particularly space mapping, including tolerance analysis and yield optimization

Abstract (cont'd)

distributed optimization over local and wide area networks supporting heterogeneous workstations

applications to waveguide elements (corrugated waveguides, dual-mode filters), multiplexers, dielectric and printed antenna design, focusing reflector arrays, filters, amplifiers, etc.

include coupling effects between the circuit and the enclosure in electronic packaging design

Research Activity Schedule

formulate mathematical approaches, begin acquisition of available external software

provide partners with current algorithms for testing

to April 1998

create electromagnetic design benchmark problems in consultation with industry

first attempts to solve those problems to identify further specific issues to be addressed

receive feedback from industry

robust, efficient *S*-parameter based design of components demonstrated

documentation of results

to October 1998

Research Activity Schedule (cont'd)

further development of mathematical, circuit-theory and field-theory based techniques

resolution of specialized user-oriented features or requirements of participating organizations

to April 1999

preliminary integration of algorithms with public domain or proprietary systems to test user-oriented features

field testing and on-site demonstration

optimization of distributed quantities demonstrated

prototype new algorithms available for installation at partner sites for the purpose of testing and feedback for final developments

to October 1999

Research Activity Schedule (cont'd)

continue algorithm development and testing

final workshop for Canadian participants

optimization capabilities relevant to packaged component/circuit design demonstrated

to April 2000

production testing and promotion of documented design methodologies

concurrent optimization with multiple EM simulators and active devices demonstrated

arrange installation at interested Canadian organizations

to October 2000

Support

Com Dev Ltd. (includes cash)
Communications Research Centre
Harris, Division Farinon
Nanowave Technologies Inc. (includes cash)
Nortel Technology
OptEM Engineering, Inc.
SPAR Aerospace Ltd.
TRIO (includes cash)
Carleton University (Nakhla and Zhang)
University of Victoria (Hoefer)

Support Letters

Gennum
DREA (Bhartia)
Quantic
University of Manitoba (Shafai)

CRC

CRC interested in antenna designs

willing to generate representative structures to verify algorithms

after successful design at McMaster CRC will build and test the structures and provide performance feedback

for each such design, problem definition, preliminary design, fabrication and test of representative structures would take about one person month of effort with some related cost

envisage one such problem to be handled in the first year, two in each of the following years

alternatively, to be decided, in the third year to address optimization of an MMIC circuit design in the 20-44 GHz frequency band, based on EM modelling

cost to CRC of an MMIC design is approximately twice that for a single antenna design

CRC prepared to provide a preliminary design and strongly interested in verifying our final design

Nortel Technology

design work associated with benchmarking of newly developed EM optimization tools

Objectives

Long-Term

create a reliable, efficient, cost–effective and robust CAE environment for specification driven top-down design of microwave and wireless circuits and one-pass design-build-test cycle

aspire to fully automate the entire design process, requiring dynamic integration of the various essential components

EM, thermal and mechanical models, physical simulation of active
devices, circuit simulators, design optimization and analog diagnosis smoothly united in a manner never before attempted in an automated fashion

Short-Term

to significantly advance the state-of-the art in automated EM design, through fully integrated tools, new design methodologies and corresponding algorithms