BRIEF HISTORY OF OSA

John W. Bandler

P.O. Box 8083, Dundas, Ontario, Canada L9H 5E7
john@bandler.com www.bandler.com

Drafted by John Bandler for Niels Fache
February 3, 1998

BRIEF HISTORY OF OSA

John W. Bandler

BC-98-2-V

February 1998

© Bandler Corporation 1998

No part of this document may be copied, translated, transcribed or entered in any form into any machine without written permission. Address enquiries in this regard to Dr. J.W. Bandler. Excerpts may be quoted for scholarly purposes with full acknowledgement of source. This document may not be lent or circulated without this title page and its original cover.

BRIEF HISTORY OF OSA

John W. Bandler

P.O. Box 8083, Dundas, Ontario, Canada L9H 5E7
john@bandler.com www.bandler.com

Drafted by John Bandler for Niels Fache
February 3, 1998

OSA Product Milestones

John Bandler founds Optimization Systems Associates (OSA) in 1983

OSA introduces powerful minimax optimizers into commercial CAD/CAE products such as EEsof's Touchstone (1985)

OSA produces the world's first yield-driven design features for Compact Software's Super-Compact (1987)

OSA makes enhancements to commercial CAD/CAE products including Compact Software's Microwave Harmonica (1988)

OSA's RoMPE, world's first commercial product for FET parameter extraction featuring S-parameters and/or DC data (1988)

OSA's HarPE, world's first commercial product for harmonic balance driven FET parameter extraction released in 1989

OSA's OSA90, world's first friendly optimization engine for performance- and yield-driven design (1990)

OSA's Datapipe Technology, OSA90's interprocess communication system (1990)

OSA Product Milestones (cont'd)

OSA's OSA90/hope, the microwave and RF harmonic optimization system released in 1991

OSA experiments with design optimization with external simulators, circuit-theoretic and field-theoretic (1991)

OSA's Empipe connection of OSA90/hope with Sonnet Software's ***em*** field simulator (1992)

OSA's software "Fulfils the requirement of microwave engineers to model and simulate nonlinear active and passive systems without having a thorough knowledge of analysis, and optimization methods," Microwave Engineering Europe (1992)

"CAD review: Non-linear CAD benchmark" by Microwave Engineering Europe (1993)

"CAD review: the 7 GHz doubler circuit" by Microwave Engineering Europe (1994)

OSA's Empipe3D connection of OSA90/hope with Hewlett-Packard's HFSS and Ansoft's Maxwell Eminence full-wave 3D simulators (1996)

OSA Product Milestones (cont'd)

OSA creates EmpipeExpress and ***empath*** for connection to Sonnet Software's ***em*** field simulator (1996)

Hewlett-Packard acquires OSA, expanding HP's CAE portfolio (1997)

OSA's Electromagnetic R&D Innovations

microstrip filter design using direct EM field simulation (1993)

yield-driven direct electromagnetic optimization (1993)

EM design of high-temperature superconducting microwave filters (1994)

Space Mapping - a fundamental new theory for design with CPU intensive simulators (1994)

optimization of planar structures with arbitrary geometry (1994)

breakthrough Geometry Capture technique (1995)

Aggressive Space Mapping for EM design (1995)

integrated harmonic balance and EM optimization (1995)

novel heterogeneous parallel yield-driven EM CAD (1995)

mixed-domain multi-simulator statistical parameter extraction and yield-driven design (1995)

parameterization of arbitrary geometrical structures (1996)

OSA's Electromagnetic R&D Innovations (cont'd)

fully-automated Space Mapping optimization of 3D structures (1996)

Space Mapping optimization with finite element (FEM) and mode matching (MM) EM simulators (1997)

OSA's Core Technologies

optimization	versatile, comprehensive, robust, up-to-date, the driving technology for OSA's software architecture
simulation	unified DC, AC and HB models and analyses
sensitivity	integrated with linear and nonlinear simulation
statistics	modeling, analysis, tolerance and yield optimization
Datapipe	connection protocols, supporting infrastructures
Geometry Capture	parameterization independent of GUI
Space Mapping	the future of modeling and optimization

OSA's Optimization

widely recognized and proven track records

OSA introduced minimax and least *p*th optimizers into Touchstone and upgraded the quasi-Newton optimizer

OSA completely reengineered the analysis and optimization capabilities of Super Compact, introduced yield optimization

OSA provided advanced minimax optimization systems to ComDev and TRW

OSA continued to pioneer novel concepts and algorithms

Huber optimization in modeling data with gross errors as well as small random variations

distributed and parallel optimization

simulated annealing global optimization

Space Mapping

Optimizers Enhanced in Touchstone (1985)

OSA introduced a minimax optimizer into Touchstone, converted from Fortran code to Pascal code

OSA introduced the least *p*th objective function into Touchstone

OSA upgraded the quasi-Newton optimization algorithm in Touchstone with a more robust and efficient code by Fletcher and Powell

OSA offered to introduce statistical analysis and yield optimization capabilities, which was perceived as ahead of its time and EEsof declined

Reengineering of Super Compact and Microwave Harmonica (1986-1988)

OSA completely reworked the optimization-simulation interface

OSA completely reworked gradient calculations

OSA introduced a minimax optimizer

OSA enhanced statistical models and Monte Carlo analysis

OSA introduced yield optimization

OSA introduced sparse matrix solvers

OSA engineered the connection between Microwave Harmonica and Super Compact

Integrated Simulation and Sensitivity Analysis

sensitivity calculations have been planned directly into OSA's software architecture

sensitivity analysis is fully integrated with the unified DC, AC and HB simulation

FAST sensitivity analysis for nonlinear circuits

Jacobians of nonlinear device models fully incorporated into harmonic balance sensitivity expressions

minimax optimization with approximate gradients

Datapipe

generic inter-process communication layer supported on both UNIX and PC platforms

connection protocols allowing flexible input/output data models

supporting infrastructure for importing S, Y and Z parameters of arbitrary formats, orders and reference impedances

expression interpreter facilitates pre-, post- and inter-Datapipe processing

multi-level Datapipe allows complex hierarchical simulation and nested optimization

externally calculated gradients

adapted by independent and external organizations for optimization driving diverse simulation engines including AWE, waveguide multiplexers, TLM, mode matching

OSA's Datapipe

encapsulating simulators as black-box executables with alphanumeric inputs and outputs

built-in support for network and parallel computing

preprocessing and postprocessing of data

preprocessing of ***x1, x2****, ...;*

FILE="*simulator*"

INPUT=(*text,* ***x1, x2****, ...)*

OUTPUT=(***y1****,* ***y2****, ...);*

postprocessing of ***y1, y2****, ...;*

hierarchy of variables

multiple simulators can be combined (serial and parallel)

simultaneous specifications in different domains

symbolic algebra and gradients

Geometry Capture
(*OSA, 1994*)

EM simulators deal directly with the layout representation of circuits in terms of absolute coordinates

geometrical coordinates are not directly related to designable parameters

geometrical parameterization is needed for every new structure

using a graphical layout editing tool the user marks the evolution of the structure as the designable parameters change

processed by OSA's Empipe to extract the relevant information

a mapping between the geometrical coordinates and the designable parameter values is established