DESIGN OF A CLASS B FREQUENCY DOUBLER USING DIRECT EM OPTIMIZATION

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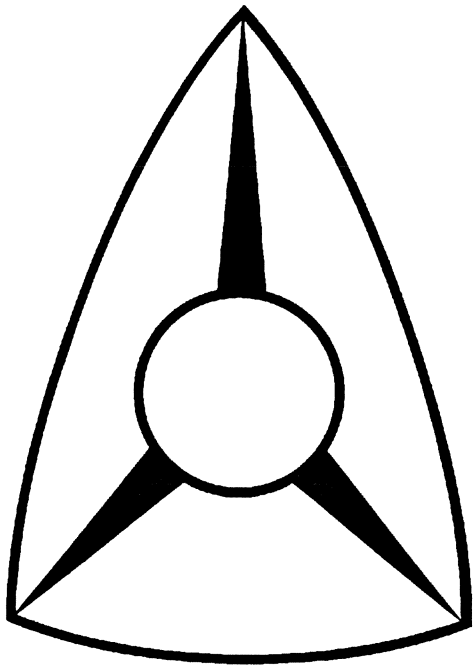
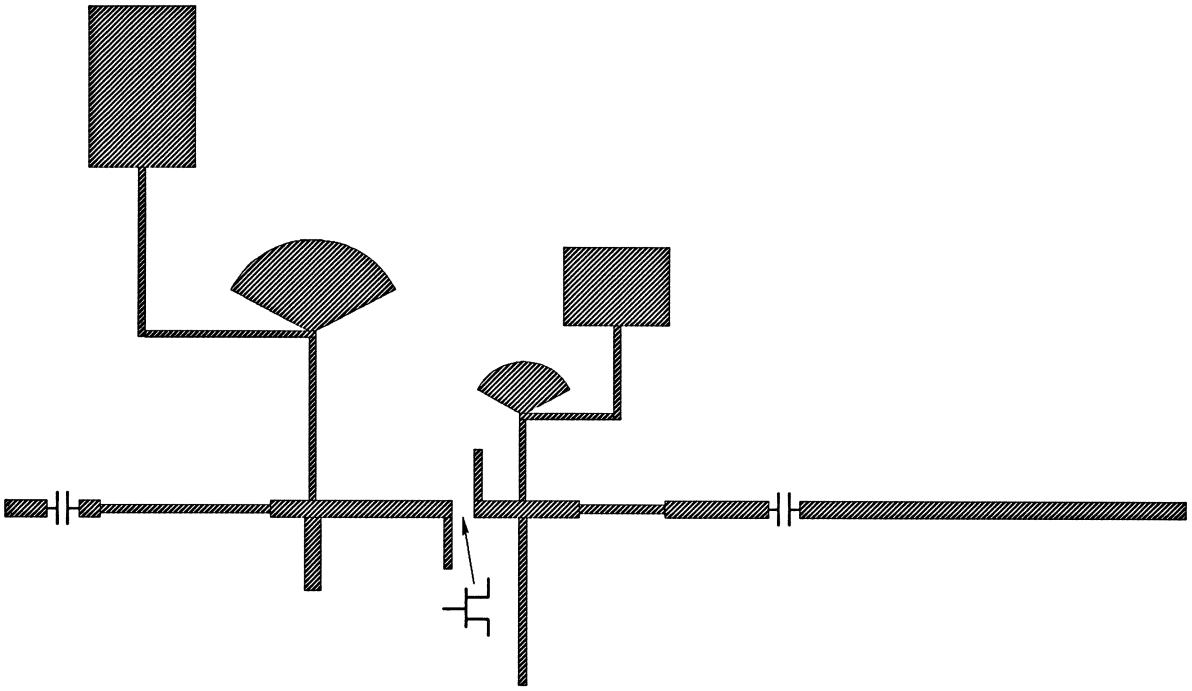
J.W. Bandler

Optimization Systems Associates Inc.
P.O. Box 8083, Dundas, Ontario
Canada L9H 5E7



Class B Frequency Doubler



a single FET for frequency doubling

two large bias pads for connecting bias voltages

the input and output matching circuits include 2 radial stubs and a number of microstrip elements

Circuit Structure and Characteristics

the circuit structure follows the CAD benchmark example provided by Microwave Engineering Europe

a single FET (NE71000) and a number of distributed microstrip elements including two radial stubs and two large bias pads

significant couplings between the distributed microstrip elements

simulation using the empirical models for the microstrip elements individually neglects these couplings

in order to take into account these couplings direct *em* optimization must be used

Direct EM Optimization

the new feature of arbitrary structure *em* optimization of OSA's Empipe is used for direct *em* optimization of this circuit

the structure between the two capacitors is considered as one element and simulated by Sonnet's *em*

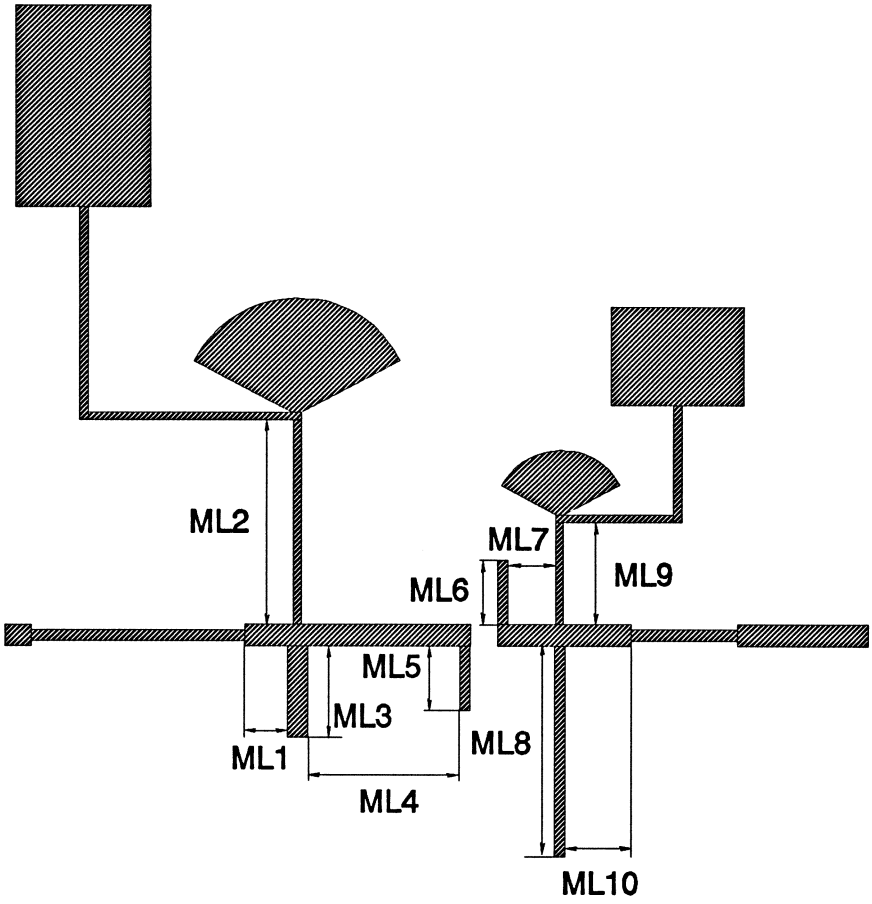
the entire circuit is directly optimized by OSA90/hope through Empipe with 10 optimization variables

design specification:

conversion gain > 3 dB
spectral purity > 20 dB

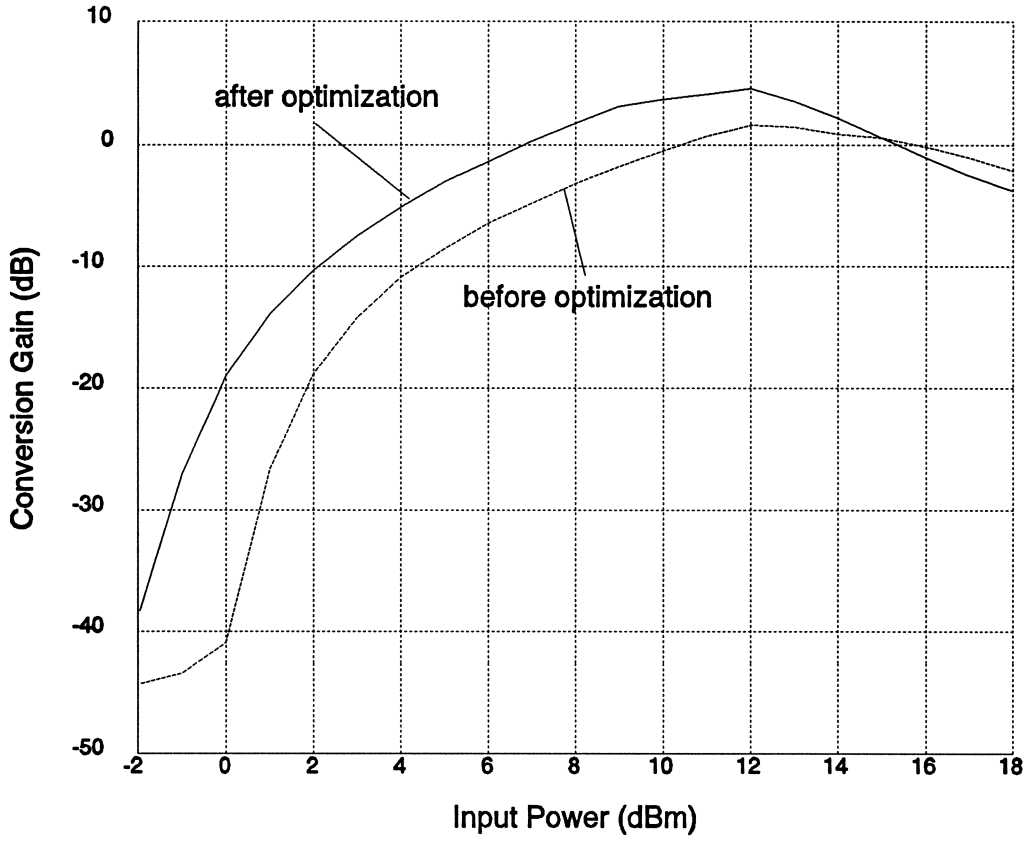
at 7 GHz and 10 dBm input power

Structure for Direct *em* Optimization

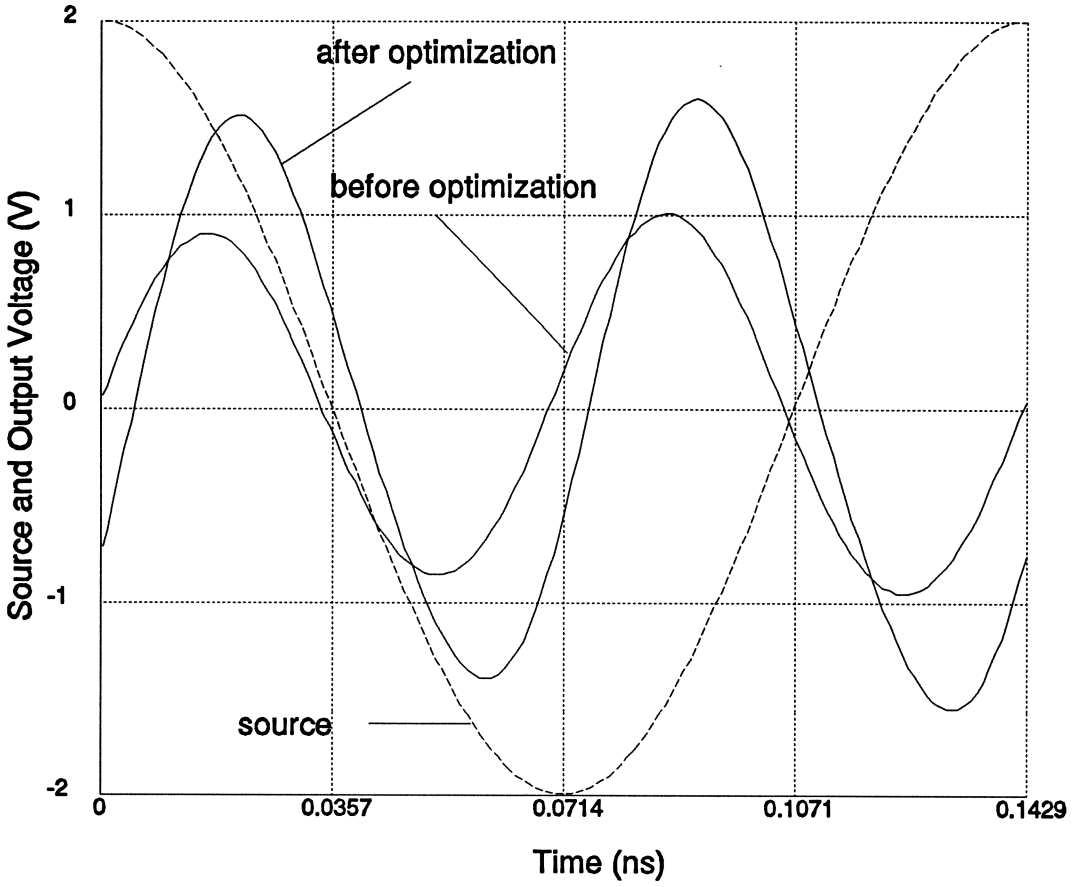


ML1, ML2, ..., ML10 are the 10 optimization variables

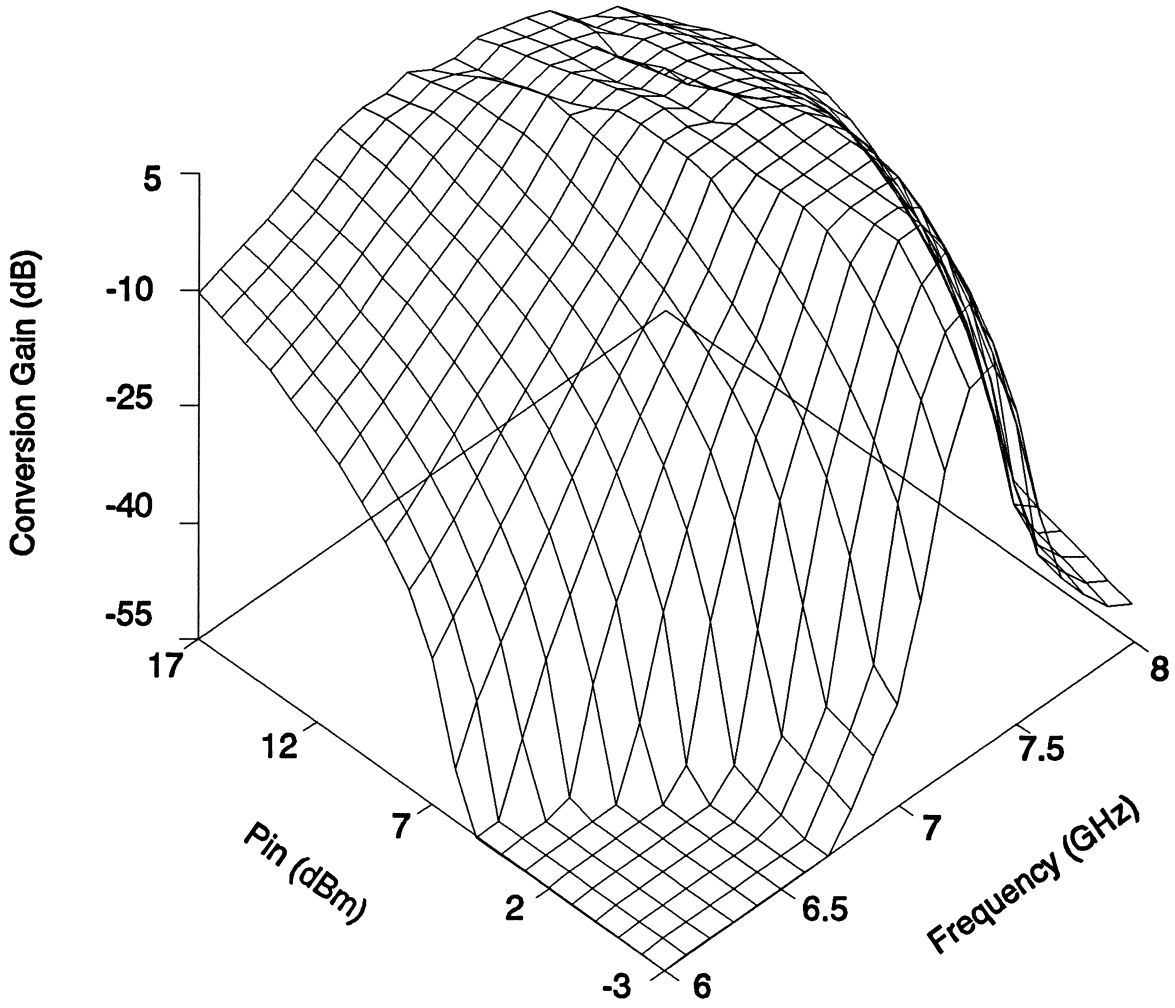
Conversion Gain Before and After Optimization



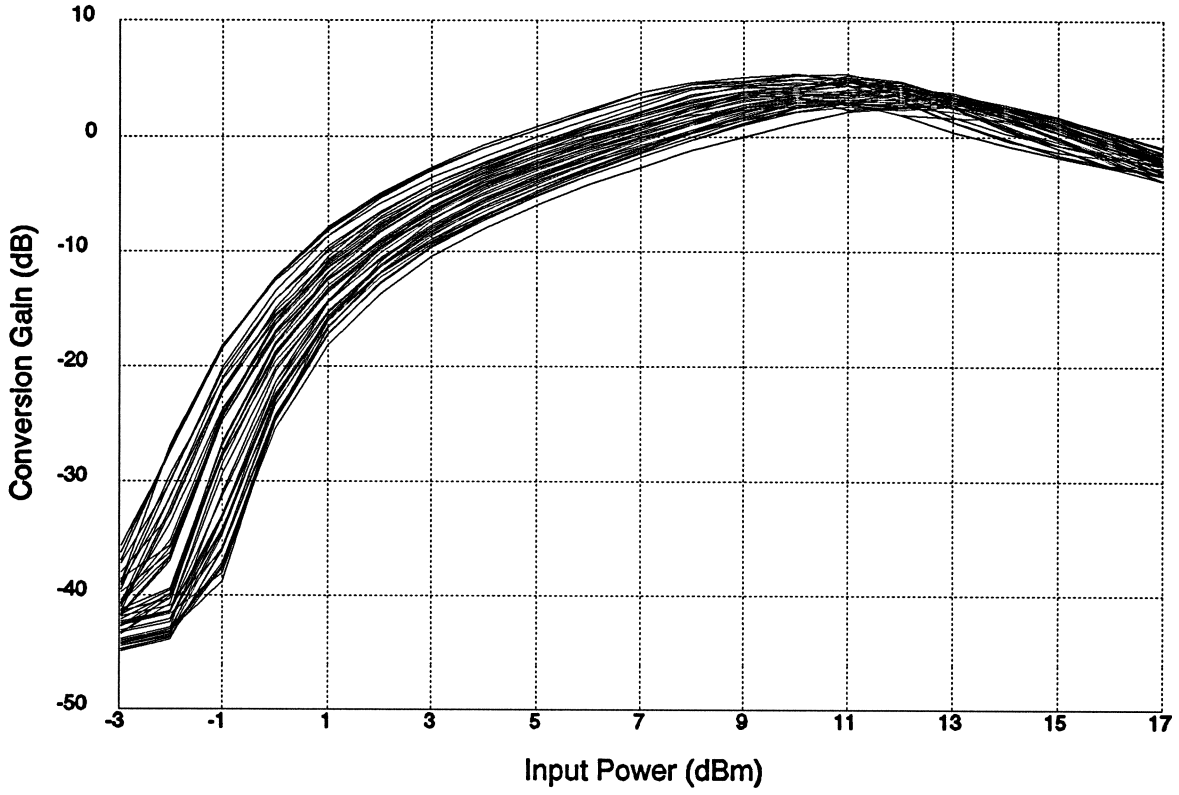
Source and Output Voltages Before and After Optimization



3D View of Conversion Gain vs. Frequency and Input Power



Monte Carlo Sweep of Conversion Gain



uniform distribution with 0.1 mil absolute tolerance is assigned to all optimization variables (ML1, ML2, ..., ML10)