MURI on "The Effects of RF Pulses on Electronic Circuits and Systems" (Administered by AFOSR)

Conclusion of Presentations by

University of Maryland, College Park (UMCP)

and Boise State University (BSU)

"Microwave Effects and Chaos in 21st Century Analog & Digital Electronics"

First Annual Review 6/8/02

Microwave Effects & Chaos (UMCP/BSU)

Research Summary

1. "Chaos" and EMI groups working together to develop improved methodology for predicting pattern of microwave field intensity in complex enclosures and techniques for limiting peak intensity
2. High impedance circuit board ground planes and resistive walls around slots found to significantly reduce EMI
3. Modeling effects of microwave irradiation on electronic devices can predict for a given transistor size, min. pulse duration that will cause a bit error & min. pulse amplitude that will cause damage
4. On-chip microwave sensors (Schottky diodes) under development by CMOS group at BSU and Focused Ion Beam group at UMCP
5. Protective circuitry and robust computer architecture proposed that would exploit on-chip sensors
6. Computers found to be much more vulnerable to upset by repetitively pulsed microwave signal (compared with CW signal)

Publications and Patents

I. Publications:

- T. Kamgaing and O. Ramahi, "A Novel Power Plane with Integrated Simultaneous Switching Noise Mitigation Capability using High Impedance Surface", submitted to *IEEE Microwave and Wireless Components Letters*

- O. Ramahi, V. Subramanian and B. Archambeault, " A Simple Finite-Difference Frequency-Domain (FDFD) Algorithm for Analysis of Switching Noise in Printed Circuit Boards and Packages", sbmitted to *IEEE Trans. Advanced Packaging*

II. Patents

- A. Iliadis, "On-chip RF Sense and Protect Circuits", provisional patent disclosure PS-2001-068

Talks at Conferences

I. Tenth National Conference on HPM Technology, Laurel, MD, April 2001

- V. Granatstein, S. Anlage, T. Antonsen, Y. Carmel, N. Goldsman, A. Illiadis, B. Jacob, J. Melngalis. P.O'Shea, E. Ott, O. Ramahi, J. Rodgers, R.J. Baker and D. Chernin, "Microwave Effects and Chaos in 21st Century Analog and Digital Electronics"

II. Int. Semiconductor Device Research Symposium, Washington, D.C., Dec. 2001

-B. Rivera, R.J. Baker and J. Melngalis, "Design and Layout of Schottky Diodes in a Standard CMOS Process"

III. Applied Computational Electromag. Soc. Symposium, Monterey, CA, March 2002

- O. Ramahi and V. Subramanian, " Efficient Power Plant Modelling Using the Finite Difference Frequency Domain Method"

IV. AMEREM , Annapolis, MD, June 2002

- V. Granatstein, S. Anlage, T. Antonsen, Y. Carmel, N. Goldsman, A. Iliadis, B. Jacob, J. Melngalis, E. Ott, O. Ramahi, J. Rodgers and R. Baker, "Studies of the Effects of HPM and Chaos on Integrated Electronics"
- S. Anlage, R. de Moraes, P. Zheng, E. Ott and T. Antonsen, "Wave Chaos in Two Dimensional Microwave Resonators"

Talks at Conferences (continued)

IV. AMEREM, Annapolis, MD, June 2002 (continued)

- X. Zheng, E. Ott, T. Antonsen, S. Anlage and O. Ramahi, "Statistical Properties of Wave Chaotic Scattering Matrices"
- L. Li and O. Ramahi, " Analysis and Mitigation of Electromagnetic Noise in Resonant Cavities and Apertures"

V. IEEE Antennas and Propagation Society Symposium, San Antonio, TX, June 2002

- L. Li and O. M. Ramahi, "Analysis and Reduction of Electromagnetic Field Leakage through Loaded Apertures"
- V. Subramanian, O. M. Ramahi, and B. Archambeault, " Calculation and Mitigation of Power Plane Resonance in Printed Circuit Boards (PCB)"
- V. Chebolu and O. M. Ramahi, "The Concurrent Complementary Operators Method applied to the Finite Difference Frequency Domain (FDFD) Simulation of Scattering Problems"
- L. Li and O. M. Ramahi, "Cavity Resonance Analysis and Mitigation Based on S-parameter Simulation using FDTD"
- O. M. Ramhai and X. Wu, "Investigation, Analysis, and Elimination of ABC-Induced Instability in FDTD Simulation"

Microwave Effects & Chaos (UMCP/BSU)

Education

1. Sudent Support

- 16 Graduate Research Assistants supported at the University of Maryland by Microwave Effects MURI and university matching funds
- 3 students supported at Boise State University

2. M.S. Thesis Completed

- V. Subramanian, "Modeling and Prediction of Switching Noise in High Speed Circuits and Packages", Mechanical Engineering Dept., University of Maryland (Advisor: O. Ramahi)