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

Introduction to 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

Goals

- **Study occurrence of high electric field regions in complex enclosures with unstable ray paths**
- **Understand failure mechanisms in electronics, esp. as voltage & detail size decrease (e.g. to 0.5V, 25nm)**
- **Specify innovations to reduce vulnerability (e.g. new computer architecture; new electronic components, circuits or packaging)**

Methodologies

- **Statistical (wave chaos) description of fields in complex topologies (e.g. metal enclosures loaded with electronics)**
- **Simulation of microwave effects on devices, circuits and systems (analog and digital)**
- **Development of robust computer architechtures**
- **Custom design and fabrication of ICs with on-chip microwave diagnostics (focused ion beams)**
- **Testing: 100MHz to 100 GHz, single or repetitive pulsing, variable pulse duration & power**

Three Interrelated Parts of Study

- **A. Wave chaos and microwave effects mitigation in enclosures**
- **B. Vulnerability and protection of devices, circuits and systems**
- **C. Microwave testing including on-chip microwave diagnostics**

Personnel

- Principal Investigator: Victor Granatstein*

- Co - PIs:

Part A: Steven Anlage[#], Thomas Antonsen, Jr.[#*], Edward Ott[#*], Omar Ramahi[**],

Part B: Neil Goldsman*, Agis Iliadis*, Bruce Jacob[^]

Part C: Yuval Carmel[+], John Melngailis*[+], John Rodgers[+]

- PI on BSU Subcontract: R. Jacob Baker (Part C)

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*Electrical Eng. ^Computer Eng. **Mechanical Eng. #Physics

[+] Inst. for Research in Electronics and Applied Physics (IREAP)

#* Physics/EE *+EE/IREAP

Presentations

Part A, Chaos in Enclosures

1. Chaos experiments
   --- S. Anlage , R. de Moraes*, E. Ott, & T. Antonsen, Jr.
2. Statistical properties of wave chaos
   ---- T. Antonsen Jr., X. Zheng*, E. Ott, S.Anlage & O. Ramahi

3. Electromagnetic noise mitigation in electronic circuit boards and enclosures
   ----- O. Ramahi, L.Li*, X.Wu*,V. Chebolu*, V. Subramanian*, T. Kamgaing, T. Antonsen, Jr., E. Ott & S. Anlage

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* Students supported by MURI

Presentations

Part B, Vulnerability and protection of devices& systems

1. Electromagnetic effects in modern electronics devices and circuits: modeling and experiment
   --- N. Goldsman, S. Adl*, Y. Bai*, X. Shao*, B. Jacob, V. Granatstein & T. Firestone*

2. Experimental studies of vulnerabilities in devices and on-chip protection
   -- A. Iliadis, Y. Carmel, J. Rodgers, X.Wen*, K.Kim* & K.Zhang*

3. Robust computer architectures
   ---- B. Jacob, N. Goldsman, S. Rodriguez*, A. Gole* & C. Dirik*

Presentations

Part C, Microwave sensing and testing

1. On-chip microwave sensors & other research at Boise State Univ.
   --- R. J. Baker, B. Knowlton, J. Melngalis, C. Cahoon*, K. DeGregorio*, B. Rivera*

2. Microwave upset testing
   --- J. Rodgers, M. Walter, T. Firestone*, & V. Granatstein