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TATSUO ITOH
TRW ENDOWED CHAIR

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October 7, 1992



Dr. Arthur K. Jordan
Code 1114SE
Electronics Division
Department of the Navy
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217-5000

Dear Dr. Jordan:

Enclosed is the Annual Report consisting of the research description and the standard publication report.

Sincerely,

Tatsuo Itoh

encl. (3 copies)

cc. Administrative Grants Officer (1 copy)
Director, NRL (1 copy)
DTIC (2 copies)

ANNUAL TECHNICAL REPORT

N00014-91-J-1651

Tatsuo Itoh
UCLA

For the Period

October 1, 1991 - September 30, 1992

Description of Research Progress

1. Nonlinear Characteristics of Superconducting Transmission Lines

This project has been continued for improvement of analysis process. It is known that the surface resistivity and the depth of penetration of high Tc superconductor may be dependent on the current density or the surface magnetic field. If a printed transmission line such as a microstrip line is made of these materials, the current distribution in the cross section of the strip can affect the local resistivity. This in turn modifies the current distribution. Hence, this is a nonlinear problem. A modified spectral domain method in combination with the iteration process was developed which can analyze the propagation characteristics of the superconducting planar transmission lines. The spectral domain method was modified in such a way that the position dependent surface resistance is included in the formulation. The current distribution is expressed in terms of Fourier transforms of the subsectional basis functions. For an assumed current distribution, an iteration process is initiated with an assumption that the surface resistance is constant. After the current distribution is obtained, the surface resistance is readjusted and the process continues until convergence is reached.

The results indicate very notable difference in two aspects in the current distributions on the strip in comparison to a perfectly conducting strip. First, the singularity of the axial current near the edges is no longer present. Second, the magnitude of transverse current is larger by two orders of magnitude than the one in a perfectly conducting microstrip line.

2. Time Domain Characterizations

A new effort has been initiated for development of an efficient time domain algorithm for characterizations of high speed pulse propagation in a microwave structure including a passive region and an active and/or nonlinear region. The concept of Diakoptics has been introduced in FDTD environment. In this proposed method, the passive portion of the structure is calculated by FDTD only once and the impulse responses at the ports connected to the active/nonlinear segment are used for subsequent numerical processing.
A one dimensional model is attacked by this method. If successful, the method saves a considerable amount of computation time required for iteration when nonlinear and/or active structures are involved. In addition, there is a possibility of reducing computer memory requirement.

Scientific Personnel

T. Itoh, Principal Investigator, Professor of Electrical Engineering
T.-W. Huang, Graduate Research Assistant
Y. Liu, Graduate Research Assistant

List of Publications, Presentations and Honors

Submitted under separate cover.

# OFFICE OF NAVAL RESEARCH
# PUBLICATION/PATENTS/PRESENTATION/HONORS REPORT
# for
# 1 Oct 91 through 30 Sept 92

R&T Number:

Contract/Grant Number:

Contract/Grant Title:

Principal Investigator:

Mailing Address:

Phone Number (with Area Code):

E-Mail Address:

a. Number of Papers Submitted to Referred Journal but not yet published: 1

b. Number of Papers Published in Referred Journals: 3
(list attached)

c. Number of Books or Chapters Submitted but not yet Published: 0

d. Number of Books or Chapters Published: 0
(list attached)

e. Number of Printed Technical Report & Non-Referred Papers: 0
(list attached)

f. Number of Patents Filed: 0

g. Number of Patents Granted: 0
(list attached)

h. Number of Invited Presentations at Workshops or Prof. Society Meetings: 9

i. Number of Presentation at Workshop or Prof. Society Meetings: 4

j. Honors/Awards/Prizes for Contract/Grant Employees:
(list attached, this might Include Scientific Soc. Awards/Offices, Promotions, Faculty Award/Offices etc.) 2

k. Total number of Graduate Students and Post-Docs Supported at least 25%, this year on this contract,grant:

Grad Students 2 and Post Docs 0

How many of each are females or minorities? (These 6 numbers are for ONR's EEO/Minority Reports; minorities Include Blacks, Aleuts Amindians, etc and those of Hispanic or Asian extraction/nationality. This Asians are singled out to facilitate meeting the varying report semantics re "under-represented")

- Grad Student Female 0
- Grad Student Minority 0
- Grad Student Asian e/n 2
- Post-Doc Female 0
- Post-Doc Minority 0
- Post-Doc Asian e/n 0

Attachment

b.

"Propagation characteristics of coplanar-type transmission lines with lossy media," IEEE Trans. Microwave Theory and Techniques, Vol.39, No.10, pp.1694-1700, October 1991, (T. Kitazawa and T. Itoh).

"Spectral domain method with entire domain and partial domain basis functions," Asia Pacific Engineering Journal, Vol.1, No.2, pp.93-107, December 1991 (C.-W. Kuo and T. Itoh).

"Pulse propagation in superconducting coplanar striplines," IEEE Trans. Microwave Theory and Techniques, Vol.40, No.3, pp.509-514, March 1992, (O. R. Baiocchi, K.-S. Kong and T. Itoh).

j. T. Itoh was selected as IEEE Distinguished Lecturer for 1992 by IEEE Australian Council.

T. Itoh was Honorary Visiting Professor at Japan Defence Academy in December 1991.