

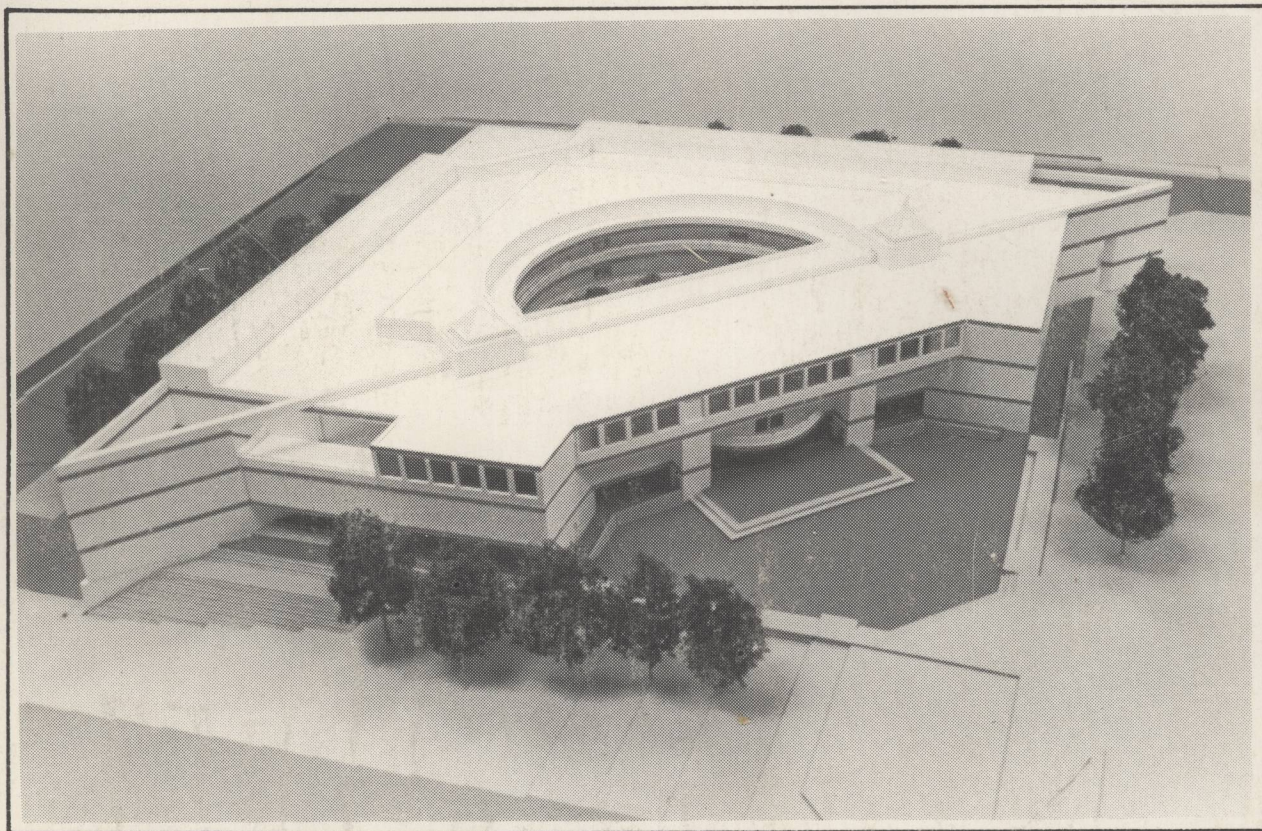


1986

**Southeastern Conference  
on Theoretical  
and Applied Mechanics**

**PROCEEDINGS**

**Volume 1**



**Hosted by  
COLLEGE OF ENGINEERING  
UNIVERSITY OF SOUTH CAROLINA**

**Held at  
CAROLINA INN  
COLUMBIA, SOUTH CAROLINA**

**Edited by  
WILLIAM F. RANSON  
JOSEPH M. BIEDENBACH**



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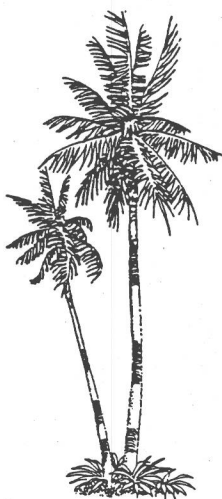


Volume I

SECTAM XIII  
PROCEEDINGS

**1986  
SOUTHEASTERN CONFERENCE  
ON THEORETICAL AND APPLIED MECHANICS**

**April 17-18, 1986  
Carolina Inn  
Columbia, South Carolina**



Hosted by  
College of Engineering  
University of South Carolina

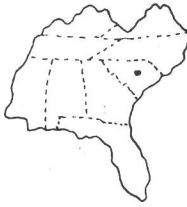
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Joseph M. Biedenbach



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## Foreword

A quarter of a century ago, SECTAM was founded by a small group of mechanics people at the Reactor Division of the Oak Ridge National Laboratory. It was the perception of the group that logistical problems prevented many researchers from availing themselves of the opportunities to interchange information with their peers--an interchange so critical to the sustaining of competence and to the achievement of progress in the solving of problems. Also, important problem areas could easily be brought to the attention of this competent research talent. Further, it was obvious, and most important, that the fledgling researchers - the graduate students - could glean many benefits from attending these regional conferences. Inspiration and acquisition of ideas concomitant with attendance at technical meetings dictated that these meetings be accessible and affordable. SECTAM was formed.

The first conference, sponsored by the Oak Ridge National Laboratory, was held in the Spring of 1962 at Gatlinburg, Tennessee. Succeeding conferences were sponsored by Georgia Tech, University of South Carolina, Tulane, North Carolina State, University of South Florida, Catholic University, VPI & SU, Vanderbilt, University of Tennessee, University of Alabama at Huntsville, and Auburn University. The thirteenth conference returns to South Carolina for the twenty-fifth anniversary of its founding.

The founding group intended that the conference not be provincial in participation and subject content. In this respect, this conference is no different from the first twelve conferences. What is different is the extent of the participation.

We are very pleased with the tremendous response to the Call for Papers, as well as, the positive replies from authors of invited papers. The papers being presented in this thirteenth conference are from all over the world. Research in mechanics is alive and well!

On behalf of the Executive Committee, I wish to extend my sincere gratitude, as well as, congratulations to all of those who have had a part in bringing this conference to a reality.

# Welcome to the University of South Carolina



UNIVERSITY OF SOUTH CAROLINA

COLUMBIA, S. C. 29208

COLLEGE OF ENGINEERING

Office of the Dean

## WELCOME TO CAROLINA!

Can it really have been 20 years since I, as executive chairman, wrote the foreword for the proceedings volume of SECTAM III? I hope that those of you who know that it really has been that long will join me in proclaiming proof that SECTAM serves now, as then, a major role in theoretical and applied mechanics activity.

We are especially pleased to be the first repeat site in the history of this now distinguished conference. A very special welcome to the founders whose vision must now be supplemented with a feeling of great satisfaction.

We hope the time you spend on our campus will be pleasant and rewarding. More importantly, we hope the contributions made to the mechanics literature will take their place alongside the other 12 volumes which document the continuing influence of SECTAM.

Yours truly,

J. D. Waugh  
Dean

JDW:dkl

The University of South Carolina: USC Aiken; USC Salkehatchie, Allendale; USC Beaufort; USC Columbia; Coastal Carolina College, Conway; USC Lancaster; USC Spartanburg; USC Sumter; USC Union; and the Military Campus.

# Welcome from the General Chairman



UNIVERSITY OF SOUTH CAROLINA

COLUMBIA, S. C. 29208

COLLEGE OF ENGINEERING

February 28, 1986

Conferees of SECTAM XIII  
University of South Carolina

Dear Colleagues:

It is with great pleasure that I extend welcome greetings to you for the thirteenth conference. SECTAM has a long history of successful meetings on all topics of interest to engineering mechanics. The breadth and scope of papers to be presented at the conference indicates the current relevant topics of mechanics to contemporary problems.

In the present world of rapidly advancing technology, Continuing Education is essential to the lifelong education of the engineer. Exchange of information such as SECTAM is certainly an important element of the educational process of the individual. The University of South Carolina is pleased to participate in the Continuing Education of the participants.

I extend an invitation to each of you to visit our campus. The College of Engineering is currently expanding the physical facilities to meet the demands of our expanding academic and research program.

Best wishes for a successful SECTAM XIII.

Sincerely,

A handwritten signature in cursive script, reading "W. F. Ranson".

W. F. Ranson  
Executive Chairman, SECTAM XIII

WFR:jdl

The University of South Carolina: USC Aiken; USC Salkehatchie, Allendale; USC Beaufort; USC Columbia; Coastal Carolina College, Conway; USC Lancaster; USC Spartanburg; USC Sumter; USC Union; and the Military Campus.





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of an Elevated Water Tower  
Subjected to Wind Gust"  
Salawu Sadiku and  
H. H. E. Leipholz  
University of Waterloo -----544

"Finite Element Frequency  
Analysis of a Thin Walled  
Cylinder"  
Joseph M. Santiago and  
Henry L. Wisniewski  
U.S. Ballistic  
Research Laboratory  
Michael H. Klaus  
NBC Defense Research and  
Development Institute, FRG

Session 18A5  
(8:30 - 10:00 a.m.)  
COMPUTATIONAL FLUIDS

Moderator: C. H. Parr  
Southwest Research  
Institute

"Numerical Study of Taylor  
Vortices in an Annular Space"  
S. M. Han, Mingsheng Yu and  
John Peddieson, Jr.  
Tennessee Technological  
University -----550

"Interdisciplinary Computational  
Fluid Dynamics"  
Wilbur L. Hankey  
Wright State University -----557

"The Importance of Conservative  
vs Non-Conservative Equation  
Type in the Numerical Simulation  
of Phase Change Problems  
Employing a Weak Formulation"  
Konstanty Cyril Masiulaniec,  
Theo G. Keith, Jr. and  
Kenneth J. DeWitt  
University of Toledo -----563

"A Model for a Detonation Wave  
in a Liquid-Gas Bubble Mixture"  
Bruce C. Norton and  
Stanley C. Kranc  
University of South Florida -----570

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(8:30 - 10:00 a.m.)  
COMPUTATIONAL METHODS II

Moderator: Mike A. Sutton  
University of  
South Carolina

"Finite Element Analysis of  
Radiative Transport Problems in  
Gray Participating Media"  
Vahan Kalenderoglu  
Bogazici University -----576

"A Source Distribution Method  
for Three-Demensional Problems  
in Potential Theory"  
Enayat Mahajerin  
Saginaw Valley State College -----585

"Hybrid Experimental Heat  
Conduction-Boundary Element  
Method"  
Faissal A. Moslehy  
University of Central  
Florida

"Two Dimensional Contact Stress  
Analysis Using a Hybrid  
Technique of Photoelasticity and  
Boundary Element Methods"  
Arun Shukla,  
Martin H. Sadd and  
E. Saliba  
University of Rhode Island -----590

"Comparison of Several Three  
Dimensional Path Independent  
Integrals"

William C. Carpenter  
University of South Florida  
D. T. Read  
National Bureau of Standards ----596  
Robert H. Dodds, Jr.  
University of Kansas-  
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"General Two-Dimensional  
Transient Heat Conduction  
Problems Using Boundary Integral  
Equation Method with New Corner  
Approximation"

Joshua C. Liu  
Alcoa Laboratories  
Michael A. Sutton  
University of South Carolina ----603

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(10:30 a.m. - 12:00 noon)  
FRACTURE III

Moderator: Walter H. Peters, III  
University of  
South Carolina

"Fracture Mechanics of Fiber  
Reinforced Ceramic Matrix  
Composites"

Ram B. Bhagat  
Pennsylvania State  
University

"Crack Propagation in an  
Orthotropic Material"

James A. Favenesi and  
Mark V. Bower  
The University of Alabama-  
Huntsville -----611

"Design Recommendations for  
Concrete Ledger Beams"

S. A. Mirza  
Lakehead University  
R. W. Furlong  
The University of Texas-  
Austin -----617

"Stress Analysis of Fiber  
Composite Monolayers with Broken  
Filaments by a Modified Model"

John N. Rossettos and  
Mohammad Shishesaz  
Northeastern University -----624

"Moment Intensity Factor for a  
Cracked Orthotropic Plate  
Subjected to Dynamic Loading"

Ali M. Sadegh and M. Kassir  
The City University  
of New York

"Central Ductile Crack Identified

by a Flat Inclusion in an  
Orthotropic Plate"

Y. M. Tsai  
Iowa State University -----631

Session 18B3  
(10:30 a.m. - 12:00 noon)  
SOIL MECHANICS II

Moderator: R. L. Baus  
University of  
South Carolina

"Surface Vibration of an Elastic  
Half-Space"

Hamid R. Hamidzadeh  
University of Southern  
Colorado -----637

"Analysis of Hydraulic  
Fracturing Stress Measurements  
in Fractured Rock"

Mario George Karfakis  
University of Wyoming -----643

"Dynamic Modelling of Pile Group  
Relaxation"

John R. Schuring  
New Jersey Institute  
of Technology  
George P. Korfiatis  
Stevens Institute of  
Technology -----650

"Dynamic Boundary Element  
Analysis of Laterally Loaded  
Piles in Non-Homogeneous Medium"

Rajan Sen  
University of South Florida  
Trevor G. Davies  
University of Glasgow  
Prasanta K. Banerjee  
State University of  
New York-Buffalo -----656

"Application of Endochronic  
Model to Granular Materials"

Paul T. Wang  
Aluminum Company of America -----663

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COMPOSITES II

Moderator: Don H. Morris  
Virginia Polytechnic  
Institute and  
State University

"Creep Modelling in Composite  
Masonry Under Plane Strain"

Subhash C. Anand and  
Ayubur Rahman  
Clemson University -----673

"The Mechanics of Corrosion in Reinforced Concrete"  
Kuan-Foung Fong,  
George R. Buchanan and  
W. A. Goodwin  
Tennessee Technological  
University -----680

"A Unified Strength Criterion for Concrete"  
Chi-L. D. Huang  
Kansas State University -----684

"Stiffness Properties of Graphite-Epoxy Filament Wound Cylinders"  
R. Noel Tolbert  
Tennessee Technological  
University -----691

Session 18B5  
(10:30 a.m. - 12:00 noon)  
EXPERIMENTAL FLUIDS II

Moderator: Trevor Moulden  
University of Tennessee  
Space Institute

"Jet Dispersion in Channels"  
S. K. Al Naib and  
J. E. Sanders  
North East London  
Polytechnic -----697

"The Estimation of Lagrangian Turbulent Velocity Autocorrelation from Eulerian Measurements"  
Lang Wah Lee  
University of Wisconsin-  
Platteville -----703

"An Experimental Study of the Behaviour of Near-Vertical Negatively Buoyant Turbulent Air Jets"  
Patrick Henry Oosthuizen  
and J. T. Paul  
Queen's University -----707

"Characteristics of Airfoils at Angles of Attack Beyond the Stall"  
Melvin H. Snyder and  
William H. Wentz, Jr.  
Wichita State University -----712

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(10:30 a.m. - 12:00 noon)  
Papers from Professional  
Colleagues from Overseas

Moderator: W. F. Ranson  
University of  
South Carolina

"Stress Analysis of Stiffened Plates in Ship Structures"  
Anand Asundi  
University of Hong Kong -----718

"Truck Riding Motions-A Theoretical Analysis"  
Mohamed M. ElMadany  
King Saud University -----727

"The Theorems of Structural Variation in Their Generalized Form"  
Tuncer Celik and  
Mehmet Polat Saka  
Gulf Polytechnic -----726

"The Application for the Theorem of Kinetic Energy in the System with Multi-Degrees of Freedom"  
Liang-Jia Yu and Yan-Jun Sun  
Northern Jiaotong University ----733

"Some Aspects of the Asymmetric Vibrations of Laminated Annular Plates of Variable Thickness"  
N. Sankaranarayanan,  
K. Chandrasekaran and  
G. Ramaiyan  
Anna University -----738

"Plasto-Elastic Strain Distribution in Multiple Pin Connectors"  
Mustafa H. M. Eissa  
Menoufia University

"A Technique for Measuring the Vertical Force Distribution Under the Foot"  
R. S. J. Palmer  
Nanyang Technological  
University

Session 18C3  
(1:30 - 3:00 p.m.)  
FRACTURE IV

Moderator: C. W. Springfield  
Auburn University

"Analysis of Crack Growth in a Landing Gear Support Lug"  
James L. Rudd  
Wright-Patterson  
Air Force Base  
David R. Showers and  
Thomas F. Christian, Jr.  
Warner-Robins Air Force Base ----744