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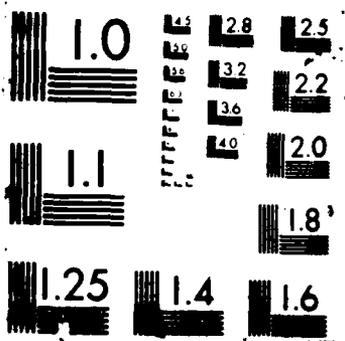
CONFERENCE ON MAXIMUM PRINCIPLES AND EIGENVALUE
PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS(U) TENNESSEE
UNIV KNOXVILLE P W SCHAEFER 30 SEP 87 AFOSR-TR-87-1605
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Dr. Phillip W. Schaefer

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The conference on Maximum Principle and Eigenvalue Problems (June 15-19, 1987, University of Tenn.) brought together more than 30 researchers to interact and listen to lectures by Dr. Protter (Main Speaker) and Drs. Levine, Weinberger, Cosner and Payne. New results in the extension of maximum principles to systems using "best possible" estimates were the highlight topic. These apply to equations in continuum mechanics.

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FINAL REPORT

Conference
on
Maximum Principles and Eigenvalue Problems
in
Partial Differential Equations

TIME: June 15-19, 1987

PLACE: University of Tennessee
Knoxville, TN 37996-1300

CONFERENCE DIRECTOR: Dr. Philip W. Schaefer
Department of Mathematics
University of Tennessee
Knoxville, TN 37996-1300

FUNDING: The Tennessee Science Alliance and the Air Force
Office of Scientific Research (AFOSR-87-0275)

REPORT: The Conference on Maximum Principles and Eigenvalue Problems in Partial Differential Equations was held during the week of June 15-19, 1987, and was attended by forty-four (44) participants, including five conferees from foreign countries.

Professor Murray H. Protter of the University of California, Berkeley, presented a series of five lectures which provided the focus and direction of topical matter of the conference. His initial lecture brought the participants from the original maximum principle for a single equation to some principles for systems and to some recent applications of maximum principles. This was further developed by the lectures of Professors Payne and Philippin who introduced the notion of "best possible" maximum principles which lead to isoperimetric inequalities for the solution and gradient of the solution to linear and nonlinear elliptic boundary value problems. Professor Horgan then applied maximum principle techniques to determine exponential decay estimates for the solution and its gradient for problems in static elasticity theory and to estimate stress concentration factors in the theory of finite anti-plane shear.

After his lecture devoted to overdetermined first order elliptic systems and the question of maximum principles for such, Professor Protter shifted his attention to the second main topic of the conference. He discussed previously obtained lower bounds for the spectrum of second order elliptic equations and introduced the notion of the generalized spectrum for elliptic systems. This concept was then amplified by Professor Cosner in his supplementary lecture in which he compared and contrasted the properties

of eigenvalues and eigenfunctions for second order elliptic systems with those for a single elliptic equation.

In his fourth lecture, Professor Protter discussed universal inequalities -valid for all domains- for eigenvalues and some improvements of such in some classical second order and higher ordered elliptic boundary value problems. This included estimates for the ratio or sum of discrete eigenvalues. Professor Levine then presented some recent results which compare Dirichlet and Neumann eigenvalues for the membrane equation.

A mini-series of lectures were devoted specifically to the Schrödinger operator. Professor Ashbaugh reported on some joint work which resulted in an optimal estimate for the "gap" between the first two eigenvalues for the Schrödinger operator in a ball. More generally, Professor Harrell developed general bounds for the spectrum for Schrödinger equations while Professor Gurarie presented an averaging method for the inverse problem which consists of determining a perturbation operator from knowledge of asymptotic formulae for the perturbed eigenvalues.

In his fifth lecture, Professor Protter discussed the asymptotic behavior of the spectrum for elliptic equations. He recalled early results in this area, discussed some recent improvements, and extended the notion to second order systems. Professor Weinberger then utilized the strong maximum principle and some invariant set analysis to extend a recent result of Pucci. He also discussed the characterization of matrices which are similar to matrices with off-diagonal elements nonnegative. This latter idea was motivated by a recent maximum principle for systems which resulted from a decoupling of the system.

In the two lectures by Professors Siegel and Pinchover, the maximum principle was employed to deduce results applicable to unbounded domains. Professor Siegel introduced a new Phragmen-Lindelöf result while Professor Pinchover discussed the structure of the set of all positive solutions for a class of elliptic operators in an unbounded domain.

The proceedings of the conference will appear as a volume in the Pitman Research Notes in Mathematics series which is published by Longman UK Limited. A copy will be provided upon publication. It is anticipated that the volume will be available early in 1988.

The program for the conference is included in appendix 1. The list of official participants in the conference and their university affiliation is provided in appendix 2. In appendix 3 we include copies of some letters which give a general assesment of the conference.

A financial report will be prepared by the Controller's Office of the University of Tennessee. It is noted that we were able to fund thirty participants instead of the proposed twenty-five as a result of the use of super-saver air fares and a special rate for lodging.



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PROGRAM

Conference
on
Maximum Principles and Eigenvalue Problems
in
Partial Differential Equations

sponsored by

The Tennessee Science Alliance
and
The Air Force Office of Scientific Research

MONDAY, June 15, 1987

- 8:30-8:55 Registration, Ayres Hall, Room 119.
9:00-9:15 Formal Opening, Buehler Hall, Room 414 (All talks).
9:20-10:20 M.H. Protter "Generalized Maximum Principles and Gradient Bounds."

COFFEE AND DOUGHNUTS, Ayres Hall, Room 119

- 11:00-12:00 L.E. Payne, "Some Applications of Maximum Principles to Isoperimetric Inequalities."
2:00-3:00 G.A. Philippin, "Applications of the Maximum Principle to a Variety of Problems Involving Elliptic Differential Equations."

REFRESHMENTS, Ayres Hall, Room 119

TUESDAY, June 16, 1987

- 9:00-10:00 M.H. Protter, "Overdetermined First Order Elliptic Systems."

COFFEE AND DOUGHNUTS, Ayres Hall, Room 119

- 11:00-12:00 C.O. Horgan, "Some Applications of Maximum Principles in Linear and Nonlinear Elasticity."
2:00-2:25 D. Siegel, "The Dirichlet Problem in a Half-Space and a New Phragmén-Lindelöf Principle."
2:30-2:55 Y. Pinchover, "On Positive Solutions of Elliptic Equations with Periodic Coefficients in Unbounded Domains."

REFRESHMENTS, Ayres Hall, Room 119

3:30-3:55 M. Ashbaugh, "Optimal Lower Bounds for Eigenvalue Gaps for Schrodinger Operators with Symmetric Single-Well Potentials."

4:00-4:25 D. Gurarie, "Spectra of Anharmonic Oscillators."

WEDNESDAY, June 17, 1987

9:00-10:00 M.H. Protter, "Lower Bounds for the Spectrum of Second Order Elliptic Equations."

COFFEE AND DOUGHNUTS, Ayres Hall, Room 119

11:00-12:00 G.C. Cosner, "Spectrum, Generalized Spectrum and Eigenfunctions for Second Order Systems."

1:30-10:00 Smoky Mountains excursion-dinner on your own in Gatlinburg and time for shopping and/or sightseeing.

THURSDAY, June 18, 1987

9:00-10:00 M.H. Protter, "Universal Inequalities for Eigenvalues."

COFFEE AND DOUGHNUTS, Ayres Hall, Room 119

11:00-12:00 H.A. Levine, "Inequalities Between Dirichlet and Neumann Eigenvalues."

2:00-3:00 E.M. Harrell, "Generalized Spectral Bounds for Schrodinger Equations."

REFRESHMENTS, Ayres Hall, Room 119

7:00-8:30 Banquet, Holiday Inn, Cumberland Suite

FRIDAY, June 19, 1987

9:00-10:00 M.H. Protter, "Asymptotic Behavior of the Spectrum for Elliptic Equations."

COFFEE AND DOUGHNUTS, Ayres Hall, Room 119

11:00-12:00 H.F. Weinberger, "Some Remarks on Maximum Principles for Systems."

UT Library is located across Cumberland Ave. from Ayres Hall and is open from 8:00 a.m. to 6:00 p.m.

The seminar rooms 209A, 209B, 309A, 309B in Ayres Hall are available Monday through Thursday for participants for study and research.

Conference
on
Maximum Principles and Eigenvalue Problems
in
Partial Differential Equations

List of Participants

Principal Lecturer

Murray H. Protter
University of California, Berkeley
Berkeley, California 94720

Contributory Lecturers - One hour Lectures

G. Chris Cosner
University of Miami
Coral Gables, FL 33124

Evans Harrell
Georgia Institute of Technology
Atlanta, GA 30332

Cornelius O. Horgan
Michigan State University
East Lansing, MI 48824

Howard A. Levine
Iowa State University
Ames, Iowa 50010

Lawrence E. Payne
Cornell University
Ithaca, NY 14853

Gerard A. Philippin
Universite' Laval
Quebec, G1K 7P4, Canada

Hans F. Weinberger
University of Minnesota
Minneapolis, MN 55455

Contributory Lecturers - Half Hour Lectures

Mark S. Ashbaugh
University of Missouri
Columbia, MO 65211

David Gurarie
Case Western Reserve University
Cleveland, OH 44106

Yehuda Pinchover
University of California
Los Angeles, CA 90024

David Siegel
University of Waterloo
Waterloo, Ontario N2L 3G1, Canada

Participants

David Adams
University of Kentucky
Lexington, KY 40506

Karen Ames
Iowa State University
Ames, IA 50010

Richard Brown
University of Alabama
Tuscaloosa, AL 35487-1416

Steve Cox
Rensselaer Polytechnic Institute
Troy, NY 12180

Philip Crooke
Vanderbilt University
Nashville, TN 37235

George Dassios
University of Patros
Patros, Greece

Anne Dow
Maharishi Int'l University
Fairfield, IA 52556

John Drake
Oak Ridge National Laboratory
Oak Ridge, TN 37830

Alan Elcrat
Wichita State University
Wichita, KS 67203

Vinod Goyal
Tuskegee Institute
Tuskegee, AL 36088

M. Grillakis
Courant Institute
New York, NY 10012

Don Hinton
University of Tennessee
Knoxville, TN 37996-1300

Martin Klaus
Virginia Polytechnic Inst.
Blacksburg, VA

Ian Knowles
University of Alabama-B'ham
Birmingham, AL 35294

Philip Korman
University of Cincinnati
Cincinnati, OH 45221

Mikhail Kovalyov
University of Alberta
Edmonton, Canada

James Kuttler
JHU Applied Physics Lab.
Laurel, MD 20707

Suzanne Lenhart
University of Tennessee
Knoxville, TN 37916

Roger Lewis
University of Alabama-B'ham
Birmingham, AL 35294

Gary Lieberman
Iowa State University
Ames, IA 50010

Roger Lui
Worcester Polytechnic Inst.
Worcester, MA 01609

Edward C. Nichols
University of Tennessee-Chattanooga
Chattanooga, TN 37403

George Paulik
University of Iowa
Iowa City, IA

Yoshimi Saito
University of Alabama-B'ham
Birmingham, AL 35294

Francoise Schremmer
West Chester University
West Chester, PA 19383

J. C. Song
Cornell University
Ithaca, NY 14853

Raj P. Soni
University of Tennessee
Knoxville, TN 37916

Brian Straughan
University of Glasgow
Glasgow G12 8QW Scotland

Roman Svirsky
University of Tennessee
Knoxville, TN 37916

Andrew Vogel
University of Kentucky
Lexington, KY 40506

Richard Weinacht
University of Delaware
Newark, Delaware 19716

Philip W. Schaefer, Conference Director
University of Tennessee
Knoxville, TN 37916

Iowa State University *of Science and Technology* Ames, Iowa 50011



Department of Mathematics
400 Carver Hall
Telephone 515-294-1752

June 30, 1987

Professor Philip W. Schaefer
Mathematics Department
University of Tennessee
Knoxville, TN 37916

Dear Phil,

Enclosed is my contribution to the conference proceedings. I hope it is satisfactory.

The conference was absolutely super. It was certainly the most successful conference I have been to in a long, long time. You did a superb job of managing the whole affair. Thank you once again for inviting me.

Regards,

A handwritten signature in cursive script that reads "Howard".

Howard A. Levine

HAL:jkv

Enc.

JUL 0 1987



Cornell University

DEPARTMENT OF MATHEMATICS
WHITE HALL
ITHACA, NEW YORK 14853-7901

June 30, 1987

Professor John S. Bradley
Department of Mathematics
University of Tennessee
Knoxville, TN 37996

Dear Spud,

I wanted to thank you, your Department, and the Tennessee Science Alliance for the opportunity of spending an enjoyable and fruitful six months at the University of Tennessee. You even arranged for great weather most of the time.

I also wanted to comment on the Conference on Maximum Principles and Eigenvalue Problems. It was one of the best organized, smoothly run, and mathematically interesting conferences I have ever attended. A lot of questions were thrown out and almost all of the participants were involved in either formal or informal mathematical discussion. Phil deserves almost all of the credit for making the conference such a great success, an opinion voiced by many of the participants in stating how much they enjoyed and learned from the conference. The funding from the Tennessee Science Alliance was certainly money well spent.

Again let me thank you and your colleagues for making our stay in Knoxville both profitable and enjoyable

Sincerely,

A handwritten signature in cursive script that reads "Larry".

Lawrence E. Payne

aah

JUL 2 1967

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DEPARTMENT OF MATHEMATICS

LELAND STANBURY MATHS LIBRARY

JUL 11 1967

Professor J. H. Bradley, Head,
Dept. of Mathematics
University of Tennessee
Knoxville, Tn 37916

Dear Professor Bradley:

I am writing to you to express my appreciation to your Department (and in particular to Professor H. Schaefer) for the organization of the conference on "Miscellaneous Problems in Partial Differential Equations". Professor H. Schaefer did a wonderful job in organizing and conducting the conference. His enthusiasm for the task, and for the mathematics itself, was apparent to all. It was an excellent conference and a credit to your Department and the University of Tennessee.

Sincerely,
C. O. Hunter



Cornelius O. Hunter
Professor

END

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