COMPUTATIONAL & APPLIED MATHEMATICS
Volume 25, N. 2-3, pp. 129–131, 2006

ISSN 0101-8205
www.scielo.br/cam

Preface

This volume consists of the Proceedings of the *Seminar on Inverse Problems and Applications* held in Rio de Janeiro, Brazil, March 21-24, 2006. This international meeting was organized by the National Laboratory of Scientific Computation (LNCC) of Brazil to commemorate the 25th anniversary of LNCC and to honour the seminal work of Alberto P. Calderón "On an Inverse Boundary Value Problem" that was presented by him at the opening conference of LNCC. The co-chairs of the event were M. Raupp, Director of LNCC, and J. Douglas from Purdue University. The organizing committee also consisted of C. Moura from The State University of Rio de Janeiro (UERJ), G. Perla from LNCC, J. Rivera from LNCC, E. Toroco from LNCC, and G. Uhlmann from the University of Washington.

Calderón's paper was first published in the Proceedings of the opening conference of LNCC, and we reprint the article here. He considers the following inverse boundary problem: can one determine the electrical conductivity of a body by making voltage and current measurements at the boundary? Calderón considered this problem when he was an engineer in Argentina working for the Petroleum Company of Argentina (YFF) but he did not publish his results until many years later. Fortunately he did on the occasion of the launching of LNCC in 1980. As an aside, in his speech on the occasion of being awarded an honorary degree from the Universidad Autónoma de Madrid, Calderón stated that he had enjoyed his work there but was not well treated at YFF: it goes without saying that this bad treatment was extremely fortunate for Mathematics! Shortly afterwards he went to study with A. Zygmund at the University of Chicago and became one of the most outstanding analysts of the 20th century. The only article by Calderón

in inverse problems has had a tremendous impact on the field: the problem he proposed and studied is called the "Calderón problem" in the mathematical literature. Many of the developments in inverse problems, inspired by Calderón's work, were reported in the article by G. Uhlmann "Development in Inverse Problems since Calderón's Foundational Paper" that appeared in the essays written in honor of his 75th birthday and published by the University of Chicago Press. Further developments are reported in an article by G. Uhlmann in the Selecta volume to be published by the American Mathematical Society that will include the most influential papers of Calderón.

Inverse Problems arise in practical situations such as medical imaging, exploration geophysics, and non-destructive evaluation where measurements made in the exterior of a body are used to deduce properties of the unknown interior. A large class of inverse problems arise from a physical situation modelted by a partial differential equation. The inverse problem is to determine some coefficients of the equation given some information about the solutions. Analysis of such problems brings together diverse areas of mathematics such as complex analysis, differential geometry, harmonic analysis, integral geometry, microlocal analysis, numerical analysis, optimization, partial differential equations, probability, statistics etc. and is a fertile area for interaction between pure and applied mathematics. This interplay is well represented in these proceedings where several theoretical and applied aspects of inverse problems are considered.

This book includes articles on a broad range of inverse problems including inverse scattering, inverse problems for the radiative transfer equation, the inverse problem of photoacoustic spectroscopy, emission computed tomography, and the inpainting problem with applications to crack determination. Several of the articles discuss regularization of inverse problems, an important topic given that inverse problems are ill-posed. This volume also includes papers on unique continuation and Carleman estimates, a subject closely related to inverse problems.

We thank Professor Raupp and LNCC for making the dream of honouring A.P. Calderón a reality with this wonderful seminar that also celebrated the 25 years of success of LNCC. We are also indebted to him and J. Douglas for having invited Calderón to present his paper on inverse problems in 1980. We

would also like to express our appreciation to the secretary of LNCC, Mrs. Simone, for her efficient help in all the organizational aspects of the seminar. We thank CNPq, CAPES, FAPERJ (BRASIL) for their financial support of the Conference. We are grateful to the authors of these proceedings for their high quality contributions. Furthermore, we thank all the participants for their contributions to this successful and enjoyable meeting. We are grateful also to the referees of the papers of this volume for their prompt and attentive reports.

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Gunther Uhlmann