Introduction

This special issue collects papers presented by some of the speakers at the Workshop on «Integral Equations: recent numerical developments and new applications» held at Mathematics Department of Parma University on October 29th-30th, 2009, attended by researchers coming from several Italian Universities and foreign Academic Institutions.

The development of the Boundary Element Method (BEM) continues at a good pace, with hundreds of papers and a lot of conference proceedings and books appearing every year. After more than 30 years of intensive research, BEM has matured to the point where it is a serious competitor to finite element and finite difference methods for solving scientific and engineering problems; often it is the method of choice.

Nowadays integral equations and relevant numerical methods have reached a high level of maturity and applicability which is documented by an enormous number of topics (electromagnetics, acoustics, heat conduction, fluid mechanics, wave propagation, meteorology, space research, inverse problems, geotechnical applications, geophysics, etc.) and have also become an outstanding example of a high degree of interdisciplinarity of international profile.

Despite this maturation, new theoretical results and applications seem to occur on a daily basis. As a consequence, the purpose of this workshop was to present some of these significant new mathematical and computational developments. Therefore, this volume includes either theoretical or practical contributions to the field. In particular, attention has been focused on the following research themes: variational formulation for elastic domain decomposition boundary value problems, quadrature schemes for energetic space-time boundary integral equations, fast numerical methods for three-dimensional problems, numerical solution of Volterra integral equations.

At first, we wish to thank the authors whose work has made this volume possible. This special issue contains papers corresponding to the research talks which have been properly referred.

We are indebted to the referees for their collaboration as well as their accurate work.

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We further acknowledge the Editorial Board for accepting to publish the Proceedings of the Workshop. Special thanks are due to Dr. M. Tiziana Mauro who assisted us in preparing the lay-out of this volume.

At last, we take the opportunity to thank once again both the speakers for their interesting presentations and all the participants for their meaningful and important contribution to the meeting.

<div align="right">A. Aimi, M. Diligenti</div>

Speakers

G. Monegato (Dip. Matematica, Politecnico Torino)
Space-time BIEM for wave equation problems with non homogeneous data

A. Frangi (Dip. Ingegneria Strutturale, Politecnico Milano)
Application of Boundary Integral Equations to Micro-Electro-Mechanical-Systems

G. Mastroianni (Dip. Matematica e Informatica, Univ. Basilicata)
A quadrature method for C.I.E.

I. Notarangelo (Dip. Matematica e Informatica, Univ. Basilicata)
Some new function spaces and their theoretical applications to Fredholm integral equations

M. C. De Bonis (Dip. Matematica e Informatica, Univ. Basilicata)
Numerical treatment of systems of Fredholm integral equations on the real axis

E. Messina, (Dip. Matematica e Applicazioni, Univ. Napoli "Federico II")
Preservation of equilibrium states and their stability in the numerical integration of two delays nonlinear Volterra Integral Equations

L. J. Gray (Oak Ridge National Laboratory, USA),
Level Set-Boundary Integral Simulation of the Rayleigh-Taylor Instability

R. Paolucci (Dip. Ingegneria Strutturale, Politecnico Milano)
The spectral element method: applications to earthquake and vibration engineering

A. Salvadori (DICATA, Univ. Brescia)
SIF and T stress computation via BIEs

V. Mantič (School of Engineering, Univ. Seville, Spain)
On variational formulations for elastic domain decomposition problems solved by SGBEM enforcing coupling conditions in a weak form

L. Tavara (School of Engineering, Univ. Seville, Spain)
Implementation of a symmetric boundary integral formulation for cohesive cracks in homogeneous media and at interfaces

A.-V. Phan (Univ. South Alabama, Mobile, USA)
Multiscale Transient Analysis of the DSIFs and T-Stress based on Symmetric-Galerkin BEM

W. Themistoclakis (IAC-CNR, Napoli)
A numerical approach to some kinetic equations in a dusty plasma

S. Rjasanow (Univ. des Saarlandes, Germany)
Adaptive Cross Approximation with new applications

M. Schanz (Graz Univ. of Technology, Austria)
Application of Adaptive Cross Approximation in a Time Domain Boundary Element Formulation

M. Annunziato (Dip. Matematica e Informatica,Univ. Salerno)
Fast solvers for Fredholm optimal control problems

C. Frammartino (Dip. Matematica e Informatica, Univ. Basilicata)
A Nyström method for 2s-th order BVP

L. Fermo (Dip. Matematica e Informatica, Univ. Basilicata)
A discussion on the regularizing parameter of some integral equations

A. Cardone (Dip. Matematica e Informatica, Univ. Salerno)
A numerical method for Volterra Integral Equations with periodic solution

D. Conte (Dip. Matematica e Informatica, Univ. Salerno)
Modified collocation-based numerical methods for Volterra Integral and Integro-Differential Equations

A. Aricò (Dip. Matematica e Informatica, Univ. Cagliari)
Numerical solution of the nonlinear Schrödinger equation, starting from the scattering data

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