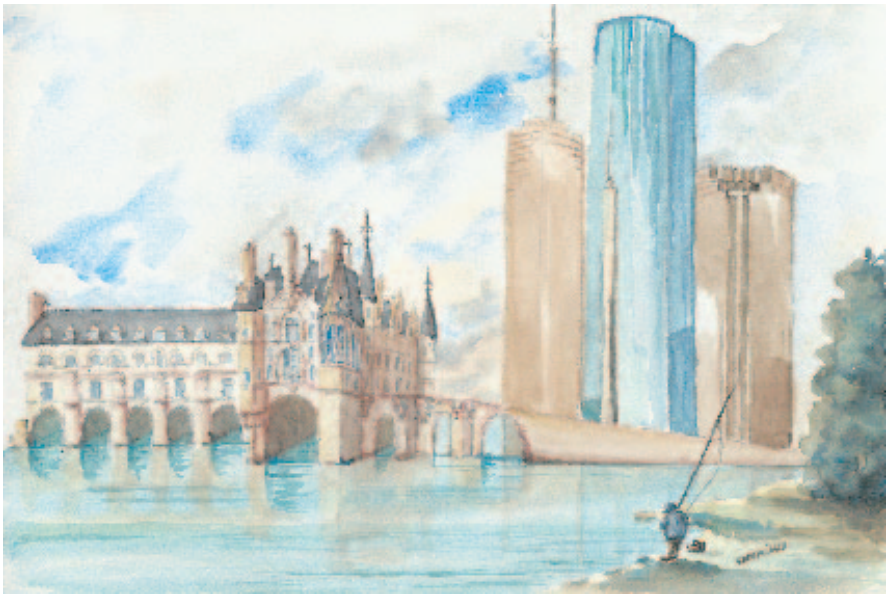
CALCUL SCIENTIFIQUE POUR LE 21ème SIECLE
COMPUTATIONAL SCIENCE FOR THE 21st CENTURY

CS 21

Conférence en l'honneur de Roland Glowinski, à l'occasion de son 60ème Anniversaire

Conference in honor of Professor Roland Glowinski on the occasion of his 60th birthday

5-7 mai 1997 - *May 5-7, 1997*
Palais des Congrès «Vinci»
Tours, France



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PROGRAMME FINAL

FINAL PROGRAM

Avant-propos

Avec l'évolution rapide des technologies avancées liées aux moyens de calcul et au traitement de l'information, on peut s'attendre à ce que le calcul scientifique ait un impact de plus en plus important sur l'ingénierie, la physique, la chimie et même les sciences économiques et sociales.

Le but du calcul scientifique est de développer et analyser des modèles mathématiques sophistiqués pour simuler et contrôler des processus complexes, tout en optimisant l'utilisation de la puissance de calcul afin de résoudre des problèmes de grande taille. Ceci nécessite des outils théoriques et algorithmiques liés à différentes disciplines : équations aux dérivées partielles, théories du contrôle et de l'optimisation, développements de logiciels, architecture des ordinateurs, parallélisation et calcul distribué.

A l'occasion du 60ème anniversaire du Professeur Roland Glowinski, les organisateurs ont souhaité rassembler les experts mondiaux dans ces domaines. L'objectif est de définir l'état de l'art et d'évaluer son impact sur les technologies futures. Nous pensons que l'éminente carrière de R. Glowinski, consacrée à l'étude de ces différents sujets est une garantie du succès scientifique de cet événement.

Les sujets de la conférence couvriront un large spectre de disciplines allant de thèmes théoriques à des applications pratiques. Toutes les conférences seront présentées par des conférenciers invités. Cependant, une session poster ainsi qu'une présentation vidéo de pages html seront ouvertes à toutes les personnes souhaitant y participer. De cette rencontre devraient émerger de nouvelles idées pour répondre aux défis lancés au calcul scientifique et ses applications pour le 21ème Siècle.

Foreword

With the emergence of advanced computational and information technologies, we can expect Computational Science to have an increasingly significant impact on Engineering, Physical and Biological Sciences and even on Social and Economical Sciences.

The goals of Computational Science are to develop and analyze sophisticated Mathematical Models in order to simulate and control complex processes, while optimizing computer resources in order to solve increasingly large problems. Reaching these goals will require theoretical and algorithmic tools drawn from the fields of Partial Differential Equations, Control Theory, Optimization Theory, Software Development, Computer Architectures, Parallelization and Distribuded Computations.

On the occasion of Professor Roland Glowinski's 60th birthday, the organizers have decided to bring together leading world experts in these areas. The goals are to define the state of the art and assess its impact on emerging technologies. We are confident that Prof. Glowinski's life long dedication to these fields and his preeminent career should guarantee the scientific success of this event.

The topics of the conference will range from abstract and theoretical subjects to applied and practical implementations. The conferences will be given by invited speakers only. Nevertheless, a poster session and a web pages demonstration will be open to each person interested. We believe that this synthesis will foster and define new ideas for the challenges of the 21st Century in Applied Mathematics and Sciences, Engineering and Computer Science.

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J.L. Lions,
Collège de France, France

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PROGRAMME SCIENTIFIQUE / *SCIENTIFIC PROGRAM*

Lundi 5 mai / *Monday, May 5*

08h00 - 09h00 Inscriptions - Café d'accueil / *Registrations - Welcome Coffee*

09h00 - 10h00 Session d'ouverture / *Opening Session*

Représentants des collectivités locales
H. MOURAY (Président de l'Université de Tours, France)
J.P. CONTZEN (Commission Européenne, Belgique)
M. RIVIER (Consulat de France à Houston, USA)
G. ETGEN (University of Houston, USA)
J.L. LIONS (Président de l'Académie des Sciences & Collège de France, France)
W. FITZGIBBON (University of Houston, USA)
L. REINHART (INRIA, France)
O. PIRONNEAU (GAMNI/SMAI, France)
J. PERIAUX (Dassault Aviation, France)

10h00 - 10h15 Variations sans Calcul / *Variations without Calculus*
J. CEA (Université de Nice, France)

10h15 - 10h45 Pause / *Break*

Session 1 :
Analyse et Modélisation / *Analysis and Modelling*
(Chairperson : M-O. Bristeau)

10h45 - 11h05 J. RAPPAZ (Ecole Polytechnique Fédérale de Lausanne, Switzerland)
Analysis and Numerical Simulation for Models of Binary Alloy Solidification

11h05 - 11h25 P. JOLY (INRIA Rocquencourt, France)
Matériaux ferromagnétiques et couches minces : modélisation mathématique et numérique

11h25 - 11h45 L. JOHNSSON (University of Houston, USA)
On the Accuracy of Multipole-like Methods for Electrostatic Fields

11h45 - 12h05 T. HUGHES (Stanford University, USA)
The Variational Multiscale Method: A Paradigm for Subgrid-Scale Modelling and Computational Fluid Mechanics

12h05 - 12h25 A. JAMESON (Princeton University, USA)
Aerodynamic Design

12h25 - 14h00 Déjeuner / *Lunch*

Session 2 :
Algèbre linéaire numérique / *Numerical Linear Algebra*
(Chairman : W. Fitzgibbon)

14h00 - 14h20 Y. KUZNETSOV (Russian Academy of Sciences, Russia)
Iterative Analysis of Finite Element Problems with Lagrange Multipliers

14h20 - 14h40 D. SORENSEN (Rice University, USA)
New Approaches to Large Scale Eigenanalysis

14h40 - 15h00 R. TAPIA (Rice University, USA)
On the Fundamental Role of Interior Point Methodology in Constrained Optimization

15h00 - 15h20 H. WALKER (Utah State University, USA)
An Approach to Continuation using Krylov Subspace Methods

15h20 - 15h50 Pause / *Break*

Session 3 :
Décomposition de domaine / Domaines fictifs et multigrilles
Domain Decomposition / Fictitious Domain Methods & Multigrids
(Chairman : P. Le Tallec)

15h50 - 16h10 Z.C. SHI (Chinese Academy of Sciences, China)
Multigrid Methods for Nonconforming Finite Elements on Nonnested Meshes

16h10 - 16h30 O. STENBACH, W. WENDLAND (University of Stuttgart, Germany)
On the Coupling of Fictitious Domains and Boundary Elements

16h30 - 16h50 J. DOUGLAS (Purdue University, USA)
An Analytical Basis for Multigrid Methods for Stabilized Finite Element Methods for the Stokes Problem

16h50 - 17h10 H. FUJITA (Meiji University, Japan), H. Kawarada (University of Chiba, Japan)
An Analytical Study of Optimal Speed of Convergence of Iterations in DDM under certain Shape Assumptions of Domains

17h10 - 17h30 V. GIRAULT (Université Pierre et Marie Curie, France)
Une méthode de domaine fictif pour le problème de Navier-Stokes

19h00 - 20h00 Cocktail de bienvenue à l'Hôtel de Ville de Tours / Welcome drink at the City Hall of Tours

Mardi 6 mai / *Tuesday, May 6*

Session 4 : Analyse mathématique / *Mathematical Analysis*
(Chairman : O. Pironneau)

08h30 - 08h50 S. ABARBANEL (University of Tel Aviv, Israël)
Bounded Error Algorithms for Solving Partial Differential Equations on Complex Domains

08h50 - 09h10 C. MORAWETZ (New York University, USA)
Existence for Transonic Flow : the Present Situation

09h10 - 09h30 L. TARTAR (Carnegie Mellon University, USA)
Approximation of H-measures

09h30 - 09h50 L. TA TSIEN (Fudan University, China)
Global solutions to the system of the motion of elastic strings

09h50 - 10h20 Pause / *Break*

Session 5 : Physique mathématique / *Mathematical Physics*
(Chairperson : M. F. Wheeler)

10h20 - 10h40 P. PERRIER (Dassault Aviation, France)
Some Problems and Paths to Next Century Unsteady Multiscale CFD

10h40 - 11h00 D. JOSEPH (University of Minnesota, USA)
Flow Induced Microstructures in Newtonian and Viscoelastic Materials

11h00 - 11h20 H. B. KELLER (CalTech, USA)
Quantum Chaos : Experiments on the Lattice Problems of Gauss

11h20 - 11h40 G. MARCHUK (Russian Academy of Sciences, Russia)
Computational Mathematics and Solution of Global Problems of Our Planet

11h40 - 12h00 M. PETTITT (University of Houston, USA)
Computational Challenges in Theoretical Chemistry

12h00 - 12h20 B. LARROUTUROU (INRIA, France)
Quelques aspects mathématiques et numériques de la réduction en cinétique chimique

12h20 - 12h40 M. GOLUBITSKY (University of Houston, USA)
Spiral Waves

12h40 - 14h00 Déjeuner / *Lunch*

14h00 - 15h30 Session poster et présentation vidéo de pages html /
Poster Session and Web Pages Demonstrations

Session 6 : Ordinateurs et systèmes / *Computers and Systems*
(Chairman : J.L. Lions)

15h30 - 15h50 P. BOHN (Dassault Aviation, France)
Une vision industrielle et peut-être philosophique du Calcul Scientifique

15h50 - 16h10 P. CASEAU (EDF, France)
Crisis or Mutation in High-Performance Computing
16h10 - 16h30 R. SCOTT (University of Houston, USA)
Programming Variational Approximations with an Embedded Language
16h30 - 16h50 P. MALLIAVIN (Académie des Sciences, France)
A Bayesian Point of View in Signal Processing

18h00 - 23h30 Visite et dîner de gala au Château d'Amboise / Visit and Gala Dinner at Amboise Castle

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Liste des posters ou pages web / *List of posters or html pages*

Recent Research on Parallel CFD
G.F. Carey, C. Harle (University of Texas at Austin, USA)

Theory and Experiment in Computational Science
J.M. Conca (INTA, Spain)

Frontal Polymerization
G. Edjlali, M. Garbey, D. Tromeur-Dervout, V. Volpert (Université Lyon 1, France)

Calcul de la trajectoire optimale d'un engin à poussée faible continue lors d'un transfert orbital : application des techniques de moyennation en contrôle optimal
S. Geoffroy (CNES & CNRS, France), R. Epenoy (CNES, France)

Formation and Propagation of Weak Shocks in a Local Supersonic Region
A. Kuzmin (University of St Petersburg, Russia)

Shape Optimisation in Unsteady Flows
E. Laporte (INRIA, France)

Contribution de l'algorithmie génétique à la synthèse d'antennes
T. Koleck (CNES & Université Paris Sud, France), P. Pajot, B. Rouland, S. Xanthakis (Logicom, France) H. Diez, J-M. Lopez (CNES, France)

Cartographie des déformations du terrain par interferométrie radar
D. Massonnet (CNES, France)

Restauration d'images spatiales acquises par des petits instruments bruités
B. Rouge (CNES, France)

Cooperative and Noncooperative Multiobjective Optimization by Means of Genetic Algorithms
M. Sefrioui (Dassault Aviation et UPMC, France), J. Périaux, B. Mantel (Dassault Aviation, France)

Parallel Fast Direct Solver for Block Tridiagonal Systems with Separable Matrices
T. Rossi, J. Toivanen (University of Jyväskylä, Finland)

Analyse et adaptations des schémas numériques d'ordre 2 MUSCL aux écoulements propulsifs instationnaires à nombres de Mach faible ou modéré
P. Vuillermoz (CNES, France), R. Carpentier, C. Viozat (INRIA & CNES, France), A. Dervieux (INRIA, France)

Mercredi 7 mai / *Wednesday, May 7*

Session 7 :
Schémas numériques en mécanique des fluides / *Numerical Schemes and CFD*
(Chairman : G. Barles)

08h30 - 08h50 F. BREZZI (Istituto di Analisi Numerica, Italy)
Discontinuous Mixed - Formulations in Fluid Mechanics

08h50 - 09h10 J. G. HEYWOOD (University of British Columbia, Canada)
Adaptive Spectral Calculations for the Spatially Periodic Navier-Stokes Equations

09h10 - 09h30 K. MORGAN (University of Wales, UK)
The Simulation of 3D Unsteady Inviscid Compressible Flows with Moving Boundaries

09h30 - 09h50 K. W. MORTON (Oxford University Computing Laboratory, UK)
Finite Element and Finite Volume Approximation of Evolution Problems

09h50 - 10h10 B. PERTHAME (Université Paris 6 - LAN, France)
Progrès récents sur les solveurs de Riemann approchés

10h10 - 10h40 Pause / *Break*

Session 8 :
Applications et mécanique des fluides / *Applications and CFD*
(Chairman : J.A. Désidéri)

10h40 - 11h00 R. BARTON (NASA, USA)
Crew Return Vehicle Aerodynamics

11h00 - 11h20 J-P. CHABARD (EDF/DER, France)
Numerical Simulation of Turbulent Flows on Unstructured Meshes using Finite Element Methods

11h20 - 11h40 D. EWING (Texas A & M University, USA)
Computational Science in Environmental Applications

11h40 - 12h00 A. QUARTERONI (Politecnico di Milano, Italy)
Modelling and Simulation of Blood Flow Problems

12h00 - 12h20 M.F. WHEELER (University of Texas at Austin, USA)
Domain Decomposition Methods for Modeling Porous Flow

12h20 - 12h40 A. BAMBERGER (IFP, France)
Simulation d'ondes en géophysique pétrolière

12h40 - 14h00 Déjeuner / *Lunch*

Session 9 :
Optimisation et contrôle / *Optimization and Control*
(Chairman : J. Périaux)

14h00 - 14h20 G. AUCHMUTY (University of Houston, USA)
Control Theory Methods for the Numerical Determination of Special Solutions of Differential Equations

14h20 - 14h40 A. BENSOUSSAN (CNES, France)
Penalization Methods Applied to Nonlinear Elliptic Unilateral Problems

14h40 - 15h00 J-L. LIONS (Collège de France, France)
On the Approximate Controllability with Global State Constraints

15h00 - 15h20 P. NEITTAANMAKI (University of Jyväskylä, Finland)
Shape and Material Optimization

15h20 - 15h40 R. TEMAM (Université Paris-Sud, France)
Quelques remarques sur le contrôle des écoulements turbulents

15h40 - 16h00 E. ZUAZUA (Universitad de Complutense de Madrid, Spain)
Controllability and Optimal Control for Parabolic Equations

16h00 - 16h30 Session de clôture / *Closing Session*

M.F. WHEELER (University of Texas at Austin, USA)
R. GLOWINSKI (University of Houston, USA & Université Paris 6, France)

Contributions au livre
"Computational Science for the 21st Century" publié par J. Wiley
Contributions to the book
"Computational Science for the 21st Century" published by J. Wiley

CHAPTER 1 MATHEMATICAL ANALYSIS

Remarks about metastability
R. Jordan, D. Kinderlehrer, F. Otto
Global solutions to the system of the motion of elastic strings
L. Ta-tsien, L. Da-qian
Regularity results for the solution of the Cauchy problem to Navier-Stokes equations
J. Necas
Analyticity, and the lack thereof, of semigroups arising from thermo-elastic plates
R. Triggiani

CHAPTER 2 NUMERICAL LINEAR ALGEBRA

Roundoff induces a chaotic behaviour for eigensolvers applied to highly nonnormal matrices
T. Braconnier, F. Chaitin-Chatelin
About Newton-Krylov methods
J. Erhel
New approaches to large scale Eigenanalysis
D. C. Sorensen
An approach to continuation using Krylov subspace methods
H. F. Walker

CHAPTER 3 MULTIGRIDS, DOMAIN DECOMPOSITION & FICTITIOUS DOMAIN METHODS

Adaptive algorithms and a posteriori error estimates on partitioned meshes
R. E. Bank, J. Périaux
Parallel domain decomposition for reaction-diffusion problems
M. Bercovier, N. Volfovsky, H. Parnas
Parallel solutions of optimal-control problems by time-domain decomposition
M. Berggren, M. Heinkenschloss
An analytic basis for multigrid methods for the stabilized finite element methods for the Stokes problem
Z. Cai, J. Douglas Jr
Numerical quadratures and mortar methods
L. Cazabeau, C. Lacour, Y. Maday

CHAPTER 4 NUMERICAL SCHEMES & CFD

CHAPTER 5 APPLICATIONS & CFD

CHAPTER 6 COMPUTATIONAL PHYSICS & CHEMISTRY

CHAPTER 7 COMPUTATIONAL ELECTROMAGNETICS

Penalization methods applied to nonlinear elliptic unilateral problems
A. Bensoussan, L. Boccardo
Approximate controllability and obstruction phenomena for quasilinear diffusion equations
J. I. Diaz, A. M. Ramos
A rapid prototyping workstation for design of distributed parameter control systems
C. LaVigna, M. Mattice, H. G. Kwatny, G. L. Blankenship
On the approximate controllability with global state constraints
J. L. Lions
Sensitivity of functionals
G. Marchuk
Approximate controllability of the semilinear heat equation: boundary control
E. Zuazua

CHAPTER 11 COMPUTERS & SYSTEMS

On numerical schemes for computing the price of look-back options
G. Barles, C. Daher, M. Romano, C. Tezier
An industrial vision of scientific computation for the 21st century
P. Bohn
Crisis or mutation in high-performance computing
P. Caseau
Filtering techniques in parallel computing
A. Ecer, H. U. Akay, N. Gopalaswamy
The description of the geographic spread in infectious disease
W. E. Fitzgibbon, M. Langlais
Vector finite elements and C++
F. Hecht, O. Pironneau
Numerical studies of the Gauss lattice problem
H. B. Keller
A robust resolution for the Zakai equation and infinitesimal generator of the asymptotic filtering process
P. Malliavin
Coifman wavelet systems: approximation, smoothness and computational algorithms
J. Tian, R. O. Wells Jr, J. E. Odergard, C. S. Burrus

The organizers of the Conference apologize for not including in the final program names with titles of papers which unfortunately were received beyond the extended deadline to be printed in time into the Proceedings.

FESTIVITES

Lundi 5 mai à 19h00 : la mairie de Tours offre un cocktail de bienvenue aux participants.

Mardi 6 mai 1997 : visite guidée et dîner de gala au Château d'Amboise.
- 18h00 départ du Palais des Congrès
- 18h50 visite guidée du Château
- 20h00 apéritif salle des Lys de France
- 20h30 dîner de gala

SOCIAL EVENTS

Monday, May 5th at 7:00 p.m: the Mayor of Tours greets participants in the city hall with a cocktail party.

Tuesday, May 6th 1997: guided tour and gala dinner at Amboise Castle.
- 6:00 p.m depature from Congress Center
- 6:50 p.m guided tour of the Castle
- 8:00 p.m cocktail, room «Lys de France»
- 8:30 p.m gala dinner

INFORMATION

Une salle de courrier électronique sera mise à la disposition des participants durant la conférence.

Vous pourrez être joint durant la conférence aux numéros de téléphone et de fax suivants :

INFORMATION

An Email room will be set up during the conference.

You will be reached during the conference at the following telephone and fax numbers:

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