

## CURRICULUM VITAE

**NAME: Tomás Chacón Rebollo.**

**CURRENT POSITION: Full Profesor of Mathematical Analysis. Speciality: Numerical Analysis.** Departamento de Ecuaciones Diferenciales y Análisis Numérico, Facultad de Matemáticas. University of Sevilla (Spain). Since May 1993.

### EDUCATIONAL QUALIFICATIONS

- **Graduation in Mathematics:** Faculty of Mathematics, Universidad de Sevilla. October 1981.
- **Spanish Ph. D.:** Faculty of Mathematics, Universidad de Sevilla, 1984. (**Advisor :** Prof. A. Valle Sánchez.)
- **French "Troisième Cycle" Ph. D.:** Laboratoire d'Analyse Numérique, University of Paris VI, 1985. (**Advisor :** Prof. O. Pironneau.)

### POSITIONS HELD

- **Assistant Professor.** Universidad de Extremadura, Facultad de Ciencias. Course 1981/82.
- **Doctoral Researcher.** MENUSIN Project at French INRIA - Rocquencourt. April 1983 to August 1985.
- **Associate Professor.** University of Sevilla, Facultad de Matemáticas. October 1985 to May 1993.
- **Invited Research Scientist.** Courant Institute, New York. January to December 1988.
- **Associate Professor.** University of Paris VI, Laboratoire d'Analyse Numérique. February to July 1991.
- **Marie Curie Programme Senior Researcher.** Dept. of Theoretical Aerodynamics. Dassault Aviation, Saint-Coud, France. April to December 1995.
- **Marie Curie Programme Senior Researcher.** Laboratoire d'Analyse Numérique, Université de Paris VI, September 2005 to September 2006.

## TEACHING ACTIVITIES

### UNDERGRADUATE TEACHING

- **Graduation in Biochemistry, University of Sevilla:** 2 semester courses on *Mathematics applied to the Biochemistry*.
- **Graduation in Chemistry, University of Sevilla:** 4 one-year courses on *Linear Algebra and Calculus of One and Several Real Variables*.
- **DEUG (1<sup>st</sup> year of graduation) in Mathematics and Physics, University of Versailles:** 1 half-year course on *Linear Algebra and Calculus of One Real Variable*.
- **Graduation in Mathematics, University of Sevilla:** 15 one-year and 2 semester courses on Elementary and Advanced Numerical Analysis, 3 one-year courses on Numerical Optimization, 3 one-year courses on Functional Analysis, 1 one-year course on Theoretical analysis of Partial Differential and Integral Equations.
- **Graduation in Pharmacy, University of Sevilla:** 1 semester course on *Mathematical Methods for Health Sciences*.

### GRADUATE TEACHING

- **Ph. D. Programmes in Mathematics, University of Sevilla:** 4 courses on *Theoretical and numerical analysis of Navier-Stokes equations*, 2 courses on *Vortex Methods*, 3 courses on **numerical approximation of Hyperbolic Conservation Laws**, in particular Shallow Water equations, 5 courses on *Numerical approximation of Parabolic Equations*.
- **Master "Scientific Computing", Pole Universitaire Leonard de Vinci, Paris:** 1 course on *Elliptic and Parabolic Partial Differential Equations*.
- **Master "Technologies of Analysis in the Information Society", University of Sevilla:** 3 courses on *Mathematical and numerical modelling of continuous systems by 1D models* (traffic flow, rivers, heat flow, dynamical systems, global heating). 1 course on *Mathematical modelling of continuous systems by 2D models* (heat flow, pollutants, fluid flow) .

## MANAGING ACTIVITIES

- **Principal Investigator** of 19 National Spanish and 7 International Research Projects (2 funded by the European Union).
- **Head of Research Team "Mathematical Modelling and Simulation of Environmental Flows"**, formed by 1 Full Professor, 4 Associate Professors, 2 Assistant Professors, 1 Post-Doctoral Assistants, and 1 Ph D student.
- **Chairman of** 3 International, 3 National Congresses, and 6 Minisimposia in International Congresses.

- **Director of Master "Technologies of Analysis for the Information Society".** University of Sevilla, Academic years 2001/02, 02/03 and 03/04.
- **Head of the Department of Differential Equations and Numerical Analysis.** Universidad de Sevilla, March 2010 to date.

## RESEARCH ACTIVITIES

My research activities have dealt with mathematical modelling, analysis and numerical solution of mathematical problems of Fluid Mechanics. I describe below the main lines of research that I have followed, together with some collaborators and the formal framework in which the collaborations have taken place:

- 1. Mathematical modelling and simulation of turbulence for fluid flows (1982-today).**
  - ***Building of models of turbulence by mathematical homogenization theory.*** Ph. D. Thesis (1982-1985). Collaboration with Dr. Ortegón, and other fellows at the University of Seville (Two Projects Funded by EU, 1987-1996), Direction of Ph. D. Thesis of D. Franco (2003) and I. Sánchez (2005).
  - ***Mathematical justification of numerical approximation techniques of turbulence models.*** Collaborations with Drs. Bernardi, Girault, Lewandowski, Murat from France and Gómez from Sevilla in the framework of Spanish-French research projects (1995-today).
  - ***Numerical modelling of turbulence by Variational Multiscale techniques.*** Project funded by the Spanish Government, in progress.
- 2. Basic aspects of numerical approximation techniques for incompressible flows (1988-today).**
  - ***Vortex Methods with Finite Elements to solve inviscid flows.*** Collaboration with Dr. T. Hou during a Post-Doc stage at Courant Institute of New York (1988). Direction of Ph. D. Thesis of I. Bless (1995) and E. Chacón (2001).
  - ***Stabilized methods with Finite Elements to solve incompressible viscous flows.*** Collaboration with Drs. Mallet, Ravachol and Stoufflet at Dassault Aviation (Saint Cloud, France) funded by the EU Marie Curie Programme (1995). Personal research on theoretical analysis (1995-2001). Direction of Ph. D. Thesis of A. Domínguez (1998).
- 3. Numerical approximation of Geophysical flows (1997-today).**
  - ***2D Shallow Water flow models by Finite Volume solvers.*** Collaboration with Drs. Gómez and Domínguez, fellows at the University of Sevilla, and Castro and Parés, from the University of Málaga. Direction of Ph. D. Thesis of E. Fernández Nieto (2003).
  - ***3D hydrostatic models by Mixed and Prismatic Stabilized Finite Elements.*** Direction of Ph. D. Thesis of D. Rodríguez Gómez (Chacón Rebollo-Rodríguez Gómez,

2004). Collaboration with Drs. Chacón Vera and Guillén from Sevilla and Lewandowsky from France (2000-today).

4. **Penalty Domain Decomposition techniques (1997-today).** Collaboration with Dr. Chacón Vera from Sevilla.
5. **Multidimensional Upwind (or Distributive) schemes (2002-today).** Collaboration with Dr. Gómez from Sevilla. Direction of Ph. D. Thesis of G. Narbona (2004).
6. **A posterior error analysis.** Collaboration with Dr. Bernardi, since 2005.

These **activities** have been **partially funded by** several **Spanish Research Ministry Grants** and **Regional Government of Andalucía, since 1992**, of which I have been the Principal Investigator.

#### **ACTIVITIES BY INVITATION**

- **Member of Scientific Comitee of several International Conferences and Schools since 1985:** French-Spanish schools of numerical simulation, Workshops on "Analysis of variables and numerical simulation of water masses exchange through Gibraltar Strait". Cádiz, 2000; Eccomas Congresses.
- **Regularly invited since 1985 to conferences, seminars and research stages** in Congresses and Research Centers of France, Italy, Spain and USA.
- **Reviewer of Mathematical Reviews since 1998.**
- **Referee of several international Scientific Journals since 1987:** CMAME, SINUM, Int J Numer Meth Flu, Physics of Fluids, SIOP, among others.

#### **MAIN ACHIEVEMENTS**

- **Formation of Research Team "Mathematical Modelling and Simulation of Environmental Flows".** Once I acquired maturity enough to advise research activities, I started to form a research team on numerical analysis, that did not exist at the University of Sevilla. The initial group was formed by 1992. We became interested by 1997 in the simulation of geophysical flows due to the large variety of overland and marine flows of ecological interest that exist in the neighbourhood of Sevilla. This is today our main activity, although we continue to work on basic aspects of numerical analysis (lines of research 1, 2, 4 and 5 above). The group is now formed by 8 senior researchers and 3 Ph. D. students.
- **Development of System of Numerical Simulators of Geophysical Flows "DamFlow":** This work was carried on since the beginning in 1997 as co-ordinated collaboration between the research team that I lead in Sevilla (mentioned in the point above) and that leaded at the University of Málaga by Dr. Parés, with a similar profile. We jointly developed the software system **DamFlow** (<http://www.damflow.com>), that integrates in a normalised way all 1D, 2D and 3D solvers developed by both teams, so

as pre-processors (grid builders) and post-processors (visualizers).

- **Mathematical theory of analysis of numerical solution of incompressible flows by Stabilized Methods.** Stabilized methods provide an alternative to the more classical mixed methods to solve incompressible flows, being computationally cheaper. For this reason they are widely used in engineering applications. I developed by 1998 a mathematical analysis theory in which both methods are analysed under a unified abstract framework. This general theory has later yield several applications: to solve the Primitive Equations of the Ocean, to prove the convergence of stabilized pseudo-spectral methods, to "cure" unstable mixed solutions of Navier-Stokes equations, etc.

## **PUBLICATIONS**

77 entries (Publications in scientific journals and chapters of books) at the MathSciNet at the present moment.

## **CONTRIBUTION TO CONGRESSES**

70 contributions to national and international congresses.

## **SCIENTIFIC DIRECTION**

Supervisor of 9 Ph. D. Thesis (one in progress).