International Conference on Boundary and Interior Layers

COMPUTATIONAL AND ASYMPTOTIC METHODS

BAIL 2024

A Coruña, June 10-14, 2024

The **International Conference on Boundary and Interior Layers, Computational and Asymptotic Methods – BAIL 2024** is an international conference aiming to communicate original research results concerning analytical and numerical methods for problems whose solutions exhibit boundary and inner layers.

The BAIL Conference series has been held every two years, except for a few interruptions since 1980. After the first congresses, promoted by John Miller and held at Trinity College in Dublin (1980, 1982, 1984), the congress moved its headquarters, being held in Novosibirsk (Russia, 1986), Shanghai (China, 1988), Colorado (USA, 1992), Beijing (China, 1994), Perth (Australia, 2002), Toulouse (France, 2004), Göttingen (Germany, 2006), Limerick (Ireland, 2008), Zaragoza (Spain, 2010), Pohang (South Korea, 2012), Prague (Czech Republic, 2014), Beijing (China, 2016), Glasgow (Scotland, 2018) and Buenos Aires (Argentina, 2022). BAIL 2024 will be the 18th edition of this congress and the first one to be held in A Coruña.

For more information about the conference, please visit the webpage: https://bail2024.udc.es/

VENUE

Rectorado de la Universidade da Coruña
Rúa Maestranza 9
15001 A Coruña (Spain)

Monday and Tuesday mornings: Paraninfo (first floor)
Remaining sessions: Sala do Consello de Goberno (second floor)

PROGRAM AT A GLANCE

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SCIENTIFIC PROGRAM AND ACTIVITIES

Monday 10

9:15-10:00 REGISTRATION OF PARTICIPANTS

10:00-10:30 OPENING CEREMONY

10:30-11:30 PLENARY TALK 1: **Michael T. Montgomery**, Department of Meteorology, Naval Postgraduate School (California, USA). *"Tropical cyclone fundamentals: The rotating-convection paradigm and a new book" (Chairman: Carlos Vázquez Cendón)*

11:30-12:00 *Coffee-Break*

12:00-13:30 SCIENTIFIC SESSION 1*: (Chairman: Michael T. Montgomery)*

- Philippe Caillol (Universidad del Bio-Bio, Chile): "*A vorticity wave packet breaking within a rapidly rotating vortex"*
- Niall Madden (University of Galway, Ireland): "*Numerically accurate formulation of implicit turbulent bottom stress in an ocean model with barotropic-baroclinic mode splitting*"
- Henar Herrero (Universidad de Castilla-La Mancha, Spain): "*A posteriori error estimate for a reduced-order model totally based on Legendre collocation"*

13:30-15:30 *Lunch*

15:30-17:30 MINI-SYMPOSIUM "***Numerical Approaches to Singularly Perturbed Problems with the Aid of Machine Learning***", organized by Gung-Min Gie (University of Louisville, EE.UU.), Youngjoon Hong (Korea Advanced Institute of Science and Technology, South Korea) and Chang-Yeol Jung (Ulsan National Institute of Science and Technology, South Korea). *(Chairman: Youngjoon Hong)*

This mini-symposium explores the innovative integration of numerical methods and artificial intelligence techniques, specifically machine learning (ML), for treating singular perturbation problems.

- **Youngjoon Hong** (Korea Advanced Institute of Science and Technology, South Korea): *"Spectral Operator Learning for Parametric PDEs Without Data Reliance"*

- **Gung-Min Gie** (University of Louisville, USA): *"Analysis and Computation of Plane Parallel Flows at a Small Viscosity"*

- **Chang-Yeol Jung** (Ulsan National Institute of Science and Technology, South Korea): *"Semi-Analytic PINN Methods for Boundary Layer Problems in a Rectangular Domain"*

- **Christos Xenophontos** (University of Cyprus, Cyprus): *"Neural Networks for Singularly Perturbed Problems"*

18:00 *Reception at the María Pita Municipal Palace (Palacio Municipal de María Pita)*

Tuesday 11

9:30-10:30 PLENARY TALK 2. **Petr Knobloch**, Department of Numerical Mathematics, Faculty of Mathematics and Physics, Charles University (Prague, Czech Republic). "*Algebraic stabilizations of convection-diffusion-reaction equations" (Chairman: Gabriel Barrenechea)*

10:30-11:30 SCIENTIFIC SESSION 2: *(Chairwoman: Henar Herrero)*

- Carmelo Clavero (Universidad de Zaragoza, Spain): "*A uniformly convergent method for solving one-dimensional parabolic singularly perturbed systems with turning points*"
- Juan Carlos Jorge (Universidad Pública de Navarra, Spain): "*A multisplitting method for solving 2D parabolic convection-diffusion systems*"

11:30-12:00 *Coffee-break*

12:00-13:30 SCIENTIFIC SESSION 3: *(Chairman: Petr Knobloch)*

- Martin Stynes (Beijing Computational Science Research Center, China): "*Optimal balanced-norm error estimate of the LDG method for singularly perturbed reaction-diffusion problems*"
- Yao Cheng (Suzhou University of Science and Technology, China): "*Supercloseness of the local discontinuous Galerkin method for a singularly perturbed convection-diffusion problem*"
- Suayip Toprakseven (Artvin Çoruh University, Turkey): "*A balanced norm error estimate of WG-FEM for fourth-order singularly perturbed reaction-diffusion problems*"

13:30-15:30 *Lunch*

15:30-17:00 SCIENTIFIC SESSION 4: *(Chairwoman: Natalia Kopteva)*

- Gabriel Barrenechea (University of Strathclyde, UK): "*Implicit-explicit schemes for incompressible flow problems with variable viscosity*"
- Ben Ashby (University of Bath, UK): "*A positivity preserving discretization of an Oldroyd-B viscoelastic fluid*"
- Alex Trenam (University of Bath, UK): "*Structure-preserving discretisations for electrolyte continuum models*"

17:00 *BAIL Steering Committee Meeting*

Wednesday 12

9:30-10:30 PLENARY TALK 3. **Jennifer Ryan**, KTH Royal Institute of Technology (Stockholm, Sweden). "*Advances in Filtering for Boundary Layers" (Chairman: Martin Stynes)*

10:30-11:30 SCIENTIFIC SESSION 5: *(Chairwoman: Jennifer Ryan)*

- Daniele Boffi (King Abdullah University of Science and Technology, Saudi Arabia): "*On the stability of a fictitious domain approach for fluid structure interaction problems*"

- Natalia Kopteva (University of Limerick, Ireland): "*A posteriori error estimates for layer solutions: from CG to DG*"

11:30-12:00 *Coffee-Break*

12:00-13:00 SCIENTIFIC SESSION 6: *(Chairman: Rodolfo Araya)*

- Alan F. Hegarty (University of Limerick, Ireland): "*A higher-order numerical method for problems with characteristic boundary layers*"
- Isabel Cordero (Universitat de València, Spain): "*Minimally implicit Runge-Kutta (MIRK) methods and applications*"

13:00-15:00 *Lunch*

15:00-20:00 *Cultural visit*

21:00 *Conference Official Dinner at Restaurant "Tira do Playa" (Andén de Riazor s/n 15011 A Coruña)*

Thursday 13

9:30-10:30 PLENARY TALK 4. **Bosco García-Archilla**, Departamento de Matemática Aplicada II, Escuela Técnica Superior de Ingeniería, Universidad de Sevilla (Sevilla, Spain). "*Recent advances in reduced order models based on proper orthogonal decomposition for incompressible flows" (Chairwoman: Julia Novo)*

10:30-11:30 SCIENTIFIC SESSION 7: *(Chairman: Bosco García-Archilla)*

- Julia Novo (Universidad Autónoma de Madrid, Spain): "*High order bounds in time for POD-ROM methods*"
- Jennifer Power (University of Bath, UK): "*Adaptive Regularisation for Optimal Control*"

11:30-12:00 *Coffee-break*

12:00-13:30 SCIENTIFIC SESSION 8: *(Chairman: Carmelo Clavero)*

- Francisco Pla (Universidad de Castilla-La Mancha, Spain): "*2D Newton Schwarz alternating method applied to the Rayleigh-Bénard convection problem*"
- Mary Chriselda Antony Oliver (University of Cambridge): "*Adaptive mixed FEM combined with the method of characteristics for stationary convection-diffusion-reaction problems*"
- Ángela Jiménez Casas (Universidad Pontificia de Comillas de Madrid, Spain): "*Equation with boundary feedback damping*"

13:30-15:30 *Lunch*

15:30-17:30 SCIENTIFIC SESSION 9: *(Chairman: Juan Carlos Jorge)*

- Aníbal Coronel (Universidad del Bio-Bio, Chile): "*Numerical study of an inverse problem for a reaction-diffusion system arising in epidemiology*"
- Marwa Zainelabdeen (Weierstrass Institute for Applied Analysis and Stochastics, Germany): "*Physics-informed neural networks for convection-dominated convection-diffusion problems*"
- Abdolreza Amiri (University of Strathclyde, UK): "*A nodally bound-preserving finite element method for time-dependent reaction-convection-diffusion equations*"
- Rodolfo Araya (Universidad de Concepción, Chile): "*Stokes problem with slip boundary conditions*"

Friday 14

9:30-10:30 PLENARY TALK 5. **Eduard Marušić-Paloka**, Department of Mathematics, University of Zagreb (Zagreb, Croatia)**.** "*Rigorous justification of the effective boundary condition on a porous wall" (Chairman: José Manuel Rodríguez Seijo)*

10:30-11:30 SCIENTIFIC SESSION 10: *(Chairman: Eduard Marušić-Paloka)*

- José Manuel Rodríguez-Seijo (Universidade da Coruña & CITMAGa, Spain): "*Analysis of the behavior of a viscous fluid between two nearby moving surfaces when the distance between them tends to zero*"
- Ángel Daniel Arós Rodríguez (Universidade da Coruña & CITMAGa, Spain): "*Asymptotic Analysis of Wear Phenomena in Elastic Elliptic Membrane Shells*"

11:30-12:00 *Coffee-break*

12:00-13:00 SCIENTIFIC SESSION 11: *(Chairman: Ángel Daniel Arós Rodríguez)*

- Pragya Shukla (Indian Institute of Information Technology and Management Gwalior, India): "*Application of non-uniform Haar wavelet on an adaptive mesh for singularly perturbed convection-diffusion problem with non-local boundary*"
- Sumit (Vellore Institute of Technology Vellore, India): "*A non-uniform Haar wavelet approximation of a singularly perturbed Fredholm integro-differential equation on a layer adaptive mesh*"

13:00-13:30 CLOSING CEREMONY

13:30-15:30 *Lunch*