

# Susana N. Gomes

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Flat 3,  
136 Blythe Road  
London W14 0HD

Office: Huxley Building 740, Imperial College London  
Email: s.gomes12@imperial.ac.uk  
Web: [www.imperial.ac.uk/people/s.gomes12](http://www.imperial.ac.uk/people/s.gomes12)

## Research interests

- Parameter estimation and optimization
- Analysis and control of partial differential equations (PDEs)
- Mean field limits of systems of interacting particles
- Multiscale systems
- Pedestrian dynamics
- Fluid dynamics/interfacial phenomena/nonlinear dynamics

## Professional appointments

**April 2017 - Present:** Postdoctoral Research Associate in the Statistics Section, Imperial College London, UK.

- Current research is focused on parameter estimation and uncertainty quantification in macroscopic models for pedestrian dynamics via optimization or Bayesian methods.
- Additional interests include phase transitions in systems of interacting diffusions and control theory for PDEs.

**April 2016 - March 2017:** Postdoctoral Research Associate in the AMMP Section, Imperial College London, UK.

- Research focused on the theoretical and numerical study of phase transitions in (multi-scale) systems of interacting diffusions. Methods included Monte-Carlo solution of SDEs, and bifurcation analysis of the corresponding nonlinear Fokker-Planck equation.
- Additional interests include control theory for PDEs modelling interfaces of thin film flows in one or two dimensions, including complicated effects such as temperature or electric fields.

## Education

**October 2012 - March 2016:** PhD in Applied Mathematics and Mathematical Physics, Imperial College London, UK.

- Supervisors: Profs. G.A. Pavliotis and D.T. Papageorgiou.
- Thesis title: "Control theory for infinite dimensional dynamical systems and applications to falling liquid film flows."

**September 2010 - July 2012:** M.Sc. in Applied Analysis and Computational Mathematics (GPA: 18.6/20), University of Coimbra, Portugal.

- Applied analysis and mathematical modeling of biological problems using reaction-diffusion and advection-diffusion equations.

**September 2007 - July 2010:** B.Sc. in Mathematics (GPA: 18.1/20), University of Coimbra, Portugal.

## Training

**December 2017:** Introduction to Blackboard Learn.

**December 2017:** Introduction to Teaching for Learning.

**January 2013:** A practical guide to assessment and marking for research students who teach.

Awards and Honors

- 2016 Yael Naim Dowker Centenary Prize in Mathematics, for being the most promising PhD student based upon PhD thesis, awarded by the Department of Mathematics, Imperial College London.
- Finalist of the 2015 edition of the Institute of Mathematics & its Applications Lighthill-Thwaites Prize, 2015.
- Best Student Talk, AMMP Day, Imperial College London, 2014.
- Roth Scholarship, covering full tuition fees and stipend for 3.5 years, awarded by the Department of Mathematics, Imperial College London.
- Awarded two *Young Talents in Mathematics* fellowships (2007/2008 and 2008/2009) by the *Calouste Gulbenkian Foundation* and an *Initiation to Research Fellowship* (2009/2010) by the *Portuguese Foundation for Science and Technology* (FCT).
- Awarded a *João Farinha Prize* (2010) for the student completing the B.Sc. in Mathematics with the highest GPA and a *Renato Pereira Coelho Prize* for the student completing the M.Sc. in Mathematics with the highest GPA, by the Department of Mathematics, University of Coimbra.
- Awarded Merit Scholarships (2008/2009, 2011/2012) and prizes for the 3% best students in the University (2007/2008, 2008/2009, 2009/2010, 2011/2012) by the University of Coimbra.

Funding

**Travel grant** - Research Impulse (Imperial College London). May 2017.

- Financial support (travel) to attend the workshop Women in Control: New Trends in Infinite Dimensions.

**Travel grant** - Banff International Research Station for Mathematical Innovation and Discovery (BIRS, Canada). April 2017.

- Financial support (accommodation and subsistence) to attend the workshop Women in Control: New Trends in Infinite Dimensions.

**Travel subsidy grant** - American Physical Society (APS). November 2015.

- Financial support to attend the 68<sup>th</sup> Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD 2015).

**Travel grant** -The European Consortium for Mathematics in Industry (ECMI). August 2012.

- Financial support (travel and accommodation) to attend the European Summer School in Industrial Mathematics and Modelling Week.

**Travel grant** - CoLab and UTAustin. August 2011.

- Financial support (travel and accommodation) to attend the RTG Summer School 2011 at The University of Texas at Austin.

**Travel grant** - CoLab and UTAustin. June 2011.

- Financial support (travel and accommodation) to attend the Summer Course and Workshop on Optimization in Machine Learning at The University of Texas at Austin.

- Academic visits **September-October 2017:** Caltech - Visit Prof. Andrew Stuart to work on our joint project.
- April 2017:** Caltech - Visit Prof. Andrew Stuart to start a collaboration.
- Professional Activities Reviewer for
- Communications in Mathematical Sciences
  - IMA Journal of Applied Mathematics
  - Mathematical Modelling and Analysis
- Other Academic Activities **June 2017 - Present:** Postdoctoral Research Associate Representative, Department of Mathematics, Imperial College London, United Kingdom.
- Duties include collaborating with the Postdoc and Fellows Development Centre to organise courses and training for the PDRA staff within the Department of Mathematics, organising social activities such as informal seminar sessions, as well as engaging with senior academic staff members in order to provide specialised support for early stage career researchers.
- May 2014 - June 2015:** Secretary and co-founder of the Imperial College SIAM Student Chapter.
- Organized Junior Applied Mathematics Seminars, themed days, AMMP Day and Imperial College SIAM Student Chapter Annual Conference.
- July 2014:** Participated in the 102<sup>nd</sup> European Study Group with Industry (ESGI), University College Dublin.
- May 2014:** 3<sup>rd</sup> SIAM National Student Chapter Conference, University of Oxford.
- March 2014:** Workshop *Recent Developments in Interface and Free Boundary Problems*, University of Warwick.
- June 2013:** Young Researchers in Mathematics, University of Edinburgh.
- August 2012:** European Summer School in Industrial Mathematics and Modelling Week 2012, Technische Universität Dresden, Germany.
- July 2011:** Research Training Group Summer School 2011, The University of Texas at Austin, Texas, USA.
- May - June 2011:** Summer Course and Workshop on Optimization in Machine Learning, The University of Texas at Austin, Texas, USA.
- September 2010 - July 2012:** Student representative of the M.Sc. in Mathematics students, University of Coimbra, Portugal.
- September 2009 - July 2010:** Student representative of the B.Sc. in Mathematics students, University of Coimbra, Portugal.
- Memberships of Learned Societies
- Early Career Member, American Physical Society
  - Junior member, Isaac Newton Institute for Mathematical Sciences
  - Early Career Member, Society for Industrial and Applied Mathematics

Invited Talks

**Applied PDEs Seminar**, Department of Mathematics, Imperial College London, UK. December 2017.

- Talk: Mean field limits and phase transitions for multi-well and multi-scale interacting diffusions

**Applied Mathematics Seminar**, School of Mathematics, University of East Anglia, UK. December 2017.

- Talk: Feedback control of thin film flows

**2016-17 Warwick EPSRC Symposium: Emerging PDE models in Socio-Economic Sciences**, The University of Warwick, UK. May 2017.

- Talk: Parameter estimation for pedestrian crowd models

**Physical Applied Mathematics Seminar**, School of Mathematics, The University of Manchester, UK. November 2016.

- Talk: Feedback control of thin film flows

**IMA Lighthill-Thwaites Prize Minisymposium, Joint BMC-BAMC 2015**, Cambridge, UK. March 2015.

- Talk: Controlling Chaos in Thin Films

**Applied Mathematics and Mathematical Physics (AMMP) Day**, Imperial College London, UK. December 2014.

- Talk: Controlling Chaos in Thin Films

**Junior Fluid Dynamics Seminar**, Imperial College London, UK. April 2014.

- Talk: Feedback and Optimal Control of the Kuramoto-Sivashinsky Equation

**Research seminars in the Departments of Mathematics and Chemical Engineering**, Imperial College London, UK. 2014-2017.

Conference Presentations and Posters

**70<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics**, Denver, Colorado, USA. November 2017.

- Talk: Controlling surface roughness in the stochastic Kuramoto-Sivashinsky equation
- Talk: Control of three-dimensional waves on thin liquid films. II – Point actuated control

**ICERM Workshop: Pedestrian Dynamics: Modeling, Validation and Calibration**, Brown University, Providence, RI, USA. August 2017.

- Poster: Parameter estimation in macroscopic pedestrian dynamics

**BIRS Workshop: Women in Control: New Trends in Infinite Dimensions**, BIRS, Banff, Canada. July 2017.

- Poster: Control of three dimensional waves on thin liquid films

**APS March Meeting**, New Orleans, Louisiana, USA. March 2017.

- Talk: Controlling surface roughness in the stochastic Kuramoto-Sivashinsky equation

**58<sup>th</sup> BAMC**, Oxford, UK. April 2016.

- Talk: Controlling surface roughness in the stochastic Kuramoto-Sivashinsky equation

**IMA workshop on Computational Methods for Control of Infinite-dimensional Systems**, University of Minnesota, Minnesota, USA. March 2016.

- Poster: Feedback control of thin films

Conference  
Presentations  
and Posters  
(Continued)

68<sup>th</sup> **Annual Meeting of the APS Division of Fluid Dynamics**, Boston, Massachusetts, USA. November 2015.

- Talk: Controlling Spatiotemporal Chaos in Active Dissipative-Dispersive Nonlinear Systems

8<sup>th</sup> **GRACM**, Volos, Greece. July 2015.

- Talk: Controlling Spatiotemporal Chaos in Active Dissipative-Dispersive Nonlinear Systems

**SIAM Conference in Control & its Applications**, Paris, France. July 2015.

- Controlling Spatiotemporal Chaos in Active Dissipative-Dispersive Nonlinear Systems

56<sup>th</sup> **BAMC 2014**, Cardiff, UK. April 2014.

- Talk: Feedback and Optimal Control of the Kuramoto-Sivashinsky Equation: Stabilizing nontrivial steady states
- Poster: Feedback and Optimal Control of the Kuramoto-Sivashinsky equation

Publications  
in Preparation

**Gomes, S.N.**, Stuart, A.M. and Wolfram, M.-T., Bayesian parameter estimation for macroscopic pedestrian dynamics models, In preparation for submission in SIAM J. Appl. Math., January 2018.

**Gomes, S.N.**, Kalliadasis, S., Pavliotis, G.A. and Yatsyshin, P., Phase Transitions for the McKean-Vlasov equation in multi-well energy landscapes, In preparation for submission in Phys. Rev. E, January 2018.

Tomlin, R.J., **Gomes, S.N.**, Pavliotis, G.A. and Papageorgiou, D.T., Control of three dimensional waves on thin liquid films with blowing and suction, In preparation for submission in SIAM J. Appl. Dyn. Syst., January 2018.

Thompson, A.B., **Gomes, S.N.**, Denner, F., Dallaston, M.C. and Kalliadasis, S., Thermocapillary falling liquid films subject to inhomogeneous wall heating, In preparation for submission in Phys. Rev. Fluids, February 2018.

Peer Reviewed  
Publications

**Gomes, S.N.**, and Pavliotis, G.A., Mean field limits for interacting diffusions in a two-scale potential. *To appear*, J. Nonlinear Sci., preprint available at <https://arxiv.org/abs/1707.06713> (2017).

**Gomes, S.N.** and Tate, S.J., On the numerical solution of a T-Sylvester type matrix equation arising in the control of stochastic partial differential equations. IMA J. of Appl. Math., <https://doi.org/10.1093/imamat/hxx030> (2017).

**Gomes, S.N.**, Kalliadasis, S., Papageorgiou, D.T., Pavliotis, G.A. and Pradas, M., Controlling roughening processes in the stochastic Kuramoto-Sivashinsky equation. *Physica D* **348**: 33-43 (2017).

**Gomes, S.N.**, Papageorgiou D.T. and Pavliotis, G.A., Stabilizing non-trivial solutions of the generalized Kuramoto-Sivashinsky equation using feedback and optimal control. IMA J. Appl. Math. **82** (1): 158-194 (2017), published online March 2016.

Thompson, A.B., **Gomes, S.N.**, Pavliotis, G.A. and Papageorgiou, D.T., Stabilising falling liquid film flows using feedback control. *Phys. Fluids*, **28**: 012107 (2016).

**Gomes, S.N.**, Pradas, M., Kalliadasis, S., Papageorgiou, D.T. and Pavliotis, G.A., Controlling Spatiotemporal Chaos in Active Dissipative-Dispersive Nonlinear Systems. *Phys Rev E* **92**: 022912 (2015).

Teaching  
Experience

**Spring 2018:** Lecturer - Computational Stochastic Processes, Imperial College London, UK.

**September 2016 - Present:** Assessment/Examination activities, Imperial College London, UK.

- Assessment duties within the Department of Mathematics, including marking M.Sc. dissertations and oral presentations, as well as evaluating oral presentations for the Fluid Dynamics Across Scales Center for Doctoral Training (CDT) affiliated to the department.

**October 2012 - March 2016:** Graduate Teaching Assistant and Assistant Examiner, Imperial College London, UK.

- Courses included Introduction to Numerical Analysis, Mathematical Methods I, Mechanics, LaTeX, Multivariable Calculus, Mathematics for Chemists and Nonlinear Waves.
- Responsibilities included assisting with problem classes, marking assessments and/or tests, invigilating tests and Summer term exams and second marking Summer term exams.

**September 2011 - July 2012:** Demonstrator at Projecto Delfos Junior, Department of Mathematics, University of Coimbra, Portugal.

Student  
Supervision

**April 2016 - Present:** Mentoring a PhD student, whose project includes the control of two-dimensional dissipative PDEs arising in the modeling of thin film flows.

Computer skills

Matlab, C, Python, Mathematica, Maple, Microsoft Office.

References available upon request.