PHILIPPE H. TRINH

LECTURER IN APPLIED MATHEMATICS

Department of Mathematical Sciences, University of Bath
website: www.ptrinh.com | email: trinh@maths.ox.ac.uk | tel: +44 01865 287375

RESEARCH INTERESTS

Fluid and solid mechanics, perturbation theory and asymptotic analysis, exponential asymptotics, free-surface flows, thin films and elastocapillary flows, wave-structure interactions, hydrodynamic instabilities

RESEARCH SUMMARY

My research is motivated by a range of physical applications in fluid and solid mechanics, from classical hydrodynamics and wave-structure interactions, to thin film flow, elastocapillary systems, and biological models of tissue growth or pattern formation. My primary area of expertise concerns the study of problems that involve a breakdown of traditional techniques in perturbation theory. Many of these problems involve the study of nonlinear differential equations and require the development of specialized methodologies and techniques, such as *exponential asymptotics* or *asymptotics beyond-all-orders*.

ACADEMIC POSITIONS

2017–Present **Lecturer (Assistant Professor) in Applied Mathematics**
Department of Mathematical Sciences
University of Bath

2016–2017 **Departmental Lecturer in Mathematical Modelling**
Mathematical Institute, University of Oxford
Oxford Centre for Industrial and Applied Mathematics
with: EPSRC Centre for Industrially Focused Mathematical Modelling

2012–2016 **Darby Fellow in Applied Mathematics**
Lincoln College, University of Oxford
& Oxford Centre for Industrial and Applied Mathematics

2010–2012 **Lecturer & Research Associate**
Princeton University
Program in Applied and Computational Mathematics
with: Profs. Weinan E and Howard A. Stone

EDUCATION

2007-2010 **Doctor of Philosophy in Mathematics**
Mathematical Institute, University of Oxford
Oxford Centre for Industrial and Applied Mathematics
Supervisor: Prof. S. Jonathan Chapman
Thesis: Exponential asymptotics and free-surface flows

2006-2007 **Master of Science in Applied Mathematics**
Carleton University (Ottawa, Ontario)
School of Mathematics and Statistics
Supervisor: Prof. David E. Amundsen
Thesis: Resonant solutions of Korteweg-de Vries equations

2004-2006 **Bachelor of Mathematics in Pure Mathematics**
Carleton University (Ottawa, Ontario)
School of Mathematics and Statistics

CURRENT PHD STUDENTS

2018–Present **Josh Shelton**
Doctor of Philosophy (Ph.D.) in Mathematics
Mathematics, University of Bath

Thesis: Numerical and asymptotic approaches in free-surface flows near a singular limit
** Co-advisor with Prof. Paul Milewski (Bath)*

2018–Present **Yyanis Johnson-Llambias**
Doctor of Philosophy (Ph.D.) in Mathematics
Mathematics, University of Bath

Thesis: Singular perturbation problems in wave-structure interactions
** Co-advisor with Prof. Paul Milewski (Bath)*

2017–Present **Joseph Harris**
Doctor of Philosophy (Ph.D.) in Mathematics
Mathematics, University of Bath

Thesis: Singularities in nematic liquid crystals
** Co-advisor with Dr. Apala Majumdar (Bath)*

2016–Present **Clint Wong**
Doctor of Philosophy (Ph.D.) in Mathematics
Mathematics, University of Oxford

Thesis: Fluid flows through vegetation
** Co-advisor with Prof. S.J. Chapman (Oxford)*

2015–Present **Helen Fletcher**
Doctor of Philosophy (Ph.D.) in Mathematics
Mathematics, University of Oxford

Thesis: Active wave absorption for polychromatic waves
** Co-advisor with Prof. S.J. Chapman (Oxford)*

FUNDING & GRANTS

2019 **UK Fluids Network Short Research Visit Grant**

A grant for £1000 to fund two short research visits to Dr. Stephen Griffiths at the University of Leeds on the topic of "New approaches using exponential asymptotics for geophysical fluid dynamics".

2018 **Royal Society International Exchanges Grant**

A grant for £4000 for multiple research visits to Prof. Saleh Tanveer at the Ohio State University (USA) on the topic of "Bridging applied and theoretical approaches to exponential asymptotics".

2017 **Oxford Mathematics Summer Research Bursary**

A grant for £2500 to Bryn Davies (MMath) in order to undertake a summer research project on the study of homoclinic snaking in partial differential equations.

2016 **Oxford Mathematics Summer Research Bursary**

A grant for £2500 to Thomas Chandler (MMath) in order to undertake a summer research project on the study of splash models for breaking water waves.

2015, 2016 **EPSRC Centre in Industrially Focused Mathematical Modelling**
(2016) Joint principal investigator for an industrial mini-project on prediction of bulk properties from microstructure. Joint funding from the EPSRC Centre for Doctoral Training in Industrially Focused Mathematical Modelling (InFoMM) and National Physical Laboratory.

(2015–Present) Joint principal investigator for a Ph.D. project to develop mathematical models to predict boundary and internal processes for a high resolution computational wave flume. Joint funding from InFoMM, the US Army Corps of Engineers (USACE), and HR Wallingford Ltd.

2014, 2015 **Zilkha Fund (Lincoln College, Oxford)**

Two grants of £2000 awarded by the Trustees of the Zilkha fund to cover research trips to the University of British Columbia (hosted by Michael Ward) and to Duke University (hosted by Thomas Witelski).

TEACHING AWARDS

2010, 2017 **University of Oxford Teaching Excellence Award**
Through student and faculty nominations, I was recognized by the Mathematical, Physical, and Life Sciences Division (MPLS) for my commitment to teaching and innovative approaches in the classroom.

ACADEMIC ACHIEVEMENTS & AWARDS

2010 Oxford University Teaching Excellence Award (MPLS Division)

2010 Tuck Fellowship (IWWWFB/University of Adelaide)
Inaugural recipient; award associated with the International Workshop on Water Waves and Floating Bodies, and administered by the University of Adelaide and Australian Mathematics Society.

2007-2010 Clarendon Scholarship (University of Oxford)

2007 Commonwealth Scholarship (CSFP)

2007-2010 NSERC Postgraduate Doctoral Scholarship (Canada)

2007 Gary S. Duck Award in Physics, Math, and Photonics

2007 University Senate Medal (Carleton)

2004, 2006 Canadian Governor General's Academic Medal

2006 NSERC Postgraduate Master's Scholarship (Canada)

2006 Graduate Studies and Research Scholarship (Carleton)

2006 Carleton Mathematics Departmental Scholarship (Carleton)

2005, 2006 USRA NSERC Undergrad. Research Award (Carleton)

2005 Helga H. Shirmer Mathematics Award (Carleton)

SUBMITTED OR PRE-PRINT PUBLICATIONS

2019 Trinh, P. H., Wilson, S. K. & Stone, H. A. 2019 Elastic plates on thin viscous films. *J. Fluid Mech.* (To be submitted) arxiv.org/abs/1410.8558

REFEREED JOURNAL AND BOOK PUBLICATIONS

2018 Chandler, T. G. J. & Trinh, P. H. 2018 Complex singularities near the intersection of a free surface and wall. Part 1. Vertical jets and rising bubbles. *J. Fluid Mech.* **856**, 323–350

2017 Hammoud, Naima H., Trinh, Philippe H., Howell, Peter D. & Stone, Howard A. 2017 Influence of van der waals forces on a bubble moving in a tube. *Phys. Rev. Fluids* **2**, 063601. doi:10.1103/PhysRevFluids.2.063601

2017 Trinh, P. H. 2017 On reduced models for gravity waves generated by moving bodies. *J. Fluid Mech.* **813**, 824–859. doi:10.1017/jfm.2016.818

2016 Trinh, P. H. 2016 A topological study of gravity waves generated by moving bodies using the method of steepest descents. *Proc. Roy. Soc. A* **472** (20150833). doi:10.1098/rspa.2015.0833

2016 Crew, S. C. & Trinh, P. H. 2016 New singularities for Stokes waves. *J. Fluid Mech.* **798**, 256–283. doi:10.1017/jfm.2016.309

2016 Jamieson-Lane, A., Trinh, P. H. & Ward, M. J. 2016 Localized spot patterns on the sphere for reaction-diffusion systems: Theory and open problems. In *Math. and Comp. App. in Adv. Mod. Sci. and Eng.* (ed. J. Bélair et al.). Springer. doi:10.1007/978-3-319-30379-6_58

2016 Trinh, P. H. & Ward, M. J. 2016 The dynamics of localized spot patterns for reaction-diffusion systems on the sphere. *Nonlinearity* **29** (3), 766–806. doi:10.1088/0951-7715/29/3/766

2015 Ren, W., Trinh, P. H. & E, W. 2015 On the distinguished limits of the Navier slip model of the moving contact line problem. *J. Fluid Mech.* **772**, 107–126. doi:10.1017/jfm.2015.173

2015 Trinh, P. H. & Chapman, S. J. 2015 Exponential asymptotics and problems with coalescing singularities. *Nonlinearity* **28** (5), 1229–1256. doi:10.1088/0951-7715/28/5/1229

2014 Trinh, P. H., Wilson, S. K. & Stone, H. A. 2014 A pinned or free-floating rigid plate on a thin viscous film. *J. Fluid Mech.* **760**, 407–430. doi:10.1017/jfm.2014.526

2014 Trinh, P. H., Kim, H., Hammoud, N., Howell, P. D., Chapman, S. J. & Stone, H. A. 2014 Curvature suppresses the Rayleigh-Taylor instability. *Phys. Fluids* **26** (5), 051704. doi:10.1063/1.4876476

2014 Trinh, P. H. & Chapman, S. J. 2014 The wake of a two-dimensional ship in the low-speed limit: results for multi-cornered hulls. *J. Fluid Mech.* **741**, 492–513. doi:10.1017/jfm.2013.589

2013 Wexler, J. S., Trinh, P. H., Berthet, H., Quennouz, N., du Roure, Olivia, Huppert, H. E., Linder, A. & Stone, H. A. 2013 Bending of elastic fibres in viscous flows: the influence of confinement. *J. Fluid Mech.* **720**, 517–544. doi:10.1017/jfm.2013.49

2013 Chapman, S. J., Trinh, P. H. & Witelski, T. P. 2013 Exponential asymptotics for thin film rupture. *SIAM J. Appl. Math.* **73** (1), 232–253. doi:10.1137/120872012

2013 Trinh, P. H. & Chapman, S. J. 2013 New gravity-capillary waves at low speeds. Part 1: Linear theory. *J. Fluid Mech.* **724**, 367–391. doi:10.1017/jfm.2013.110

2013 Trinh, P. H. & Chapman, S. J. 2013 New gravity-capillary waves at low speeds. Part 2: Nonlinear theory. *J. Fluid Mech.* **724**, 392–424. doi:10.1017/jfm.2013.110

2011 Trinh, P. H., Chapman, S. J. & Vanden-Broeck, J.-M. 2011 Do waveless ships exist? Results for single-cornered hulls. *J. Fluid Mech.* **685**, 413–439. doi:10.1017/jfm.2011.325

IN PREPARATION

— Wong, C. Y. H., Trinh, P. H. & Chapman, S. J. 20– Fluid flows through vegetation. *(In preparation)*

— Chandler, T. G. J. & Trinh, P. H. 20– Complex singularities near the intersection of a free surface and wall. Part 2. Angled jets. *(In preparation)*

— Trinh, P. H., Dallaston, M. C., Kalliadasis, S., Chapman, S. J. & Wilteski, T. P. 20– Thin-film rupture for generalized disjoining pressures. *(In preparation)*

— Trinh, P. H. & Witelski, T. P. 2016 Complex singularities and selection mechanisms in nonlinear differential equations. *(In preparation)*

— Macdonald, C. B., Mäerz, T. & Trinh, P. H. 20– Thin film equations with the Closest Point Method. *(In preparation)*

— Trinh, P. H. & Vella, D. 20– Near threshold buckling analysis of a floating elastic annulus. *(In preparation)*

PHD STUDENT RESEARCH SUPERVISION

Ph.D.	=	Doctoral dissertation
M.Sc.	=	Master of Science dissertation
CDT MP	=	ESPRC Doctoral Training industrial mini project
SumRes	=	Summer research project
MMath	=	4th year dissertation or equivalent
BA Math	=	3rd year dissertation or equivalent

Year	Student	School	Type	Project title	Comments
2018–Present	Josh Shelton	Bath	Ph.D.	Free-surface flows near a singular limit	Co-advised with P.A. Milewski
2018–Present	Yyanis Johnson-Llambias	Bath	Ph.D.	Singular perturbations in wave-structure interactions	Co-advised with P.A. Milewski
2017–Present	Joseph Harris	Bath	Ph.D.	Singularities in nematic liquid crystals	Co-advised with Apala Majumdar
2016–Present	Clint Wong	Oxford	Ph.D.	Fluid flows through vegetations	Co-advised with S.J. Chapman
2015–Present	Helen Fletcher	Oxford	Ph.D.	Active wave absorption for polychromatic waves	Co-advised with S.J. Chapman & J. Whiteley
2016	Davin Lunz	Oxford	CDT MP	Prediction of bulk properties from microstructure	Co-advised with J. Chapman & M. Bruna
2012–2016	Naima Hammoud	Princeton	Ph.D.	On instabilities in thin film flows	Co-advised with H.A. Stone

UNDERGRADUATE, MMATH, AND MSC RESEARCH SUPERVISION

Ph.D.	=	Doctoral dissertation
M.Sc.	=	Master of Science dissertation
CDT MP	=	ESPRC Doctoral Training industrial mini project
SumRes	=	Summer research project
MMath	=	4th year dissertation or equivalent
BA Math	=	3rd year dissertation or equivalent

Year	Student	School	Type	Project title	Comments
2018–2019	Christopher Blake	Bath	MMath	Free-surface flows over rapidly-varying topographies	
2018–2019	Jackson Phoong	Bath	MMath	Mathematical modeling of optical fibres	
2018–2019	Reuben Russell	Bath	MMath	The multidimensional method of steepest descents	
2017–2018	Emily Flicos	Oxford	MMath	Steep standing waves and the Penney-Price conjecture	
2017–2018	John Fitzgerald	Oxford	MMath	Stokes surfaces in nonlinear three-dimensional flows	
2017–2018	Bryn Davies	Oxford	MMath	Exponential asymptotics and snaking bifurcation diagrams	
2017–2018	Liza Hadley	Oxford	MMath	Finding Neptune	
2017–2018	Charles Hutchings	Oxford	BA Math	The Abel impossibility theorem	
2016–2017	Thomas Chandler	Oxford	MMath	On the separation between free surface and rigid wall	
2016–2017	Yyanis Johnson-Llambias	Oxford	MMath	Bifurcations in water waves in finite depth	Summer funding from Lincoln College
2016–2017	Oliver Mulley	Oxford	MMath	Gravity-capillary waves with vorticity	
2016–2017	John Fitzgerald	Oxford	BA Math	Numerical methods for complex rays	Summer funding from Lincoln College
2016–2017	Charlie Hutchings	Oxford	BA Math	On the Bender-Wu problem and hydrodynamics	
Summer 2016	Thomas Chandler	Oxford	SumRes	Splash models for breaking waves	Funded by EPSRC CDT InFoMM
2015–2016	Sean Jamshidi	Oxford	MMath	Searching for new gravity-capillary waves	Presented BAMC 2016 (Oxford, UK)
2015–2016	Thomas Chandler	Oxford	MMath	Splash models for flows near the bow of a ship	Presented BAMC 2016 (Oxford, UK)
Summer 2015	Samuel Crew	Oxford	SumRes	New singularities for Stokes waves	Presented BAMC 2016 (Oxford, UK) Crew & Trinh (2016) J. Fluid Mech.
2014–2015	Amy Guyomard	Oxford	M.Sc.	The multi-dimensional method of steepest descents	
2014–2015	Alexander Gower	Oxford	MMath	Phase field models and the thin film limit	
2014–2015	Benjamin Whitlock	Oxford	MMath	Models for thin film flows on curved surfaces	
2014–2015	Jamie Cruickshank	Oxford	MMath	Tissue growth in a mono-layerd epithelium	Co-advised with S. Waters
2013–2014	Lucy Auton	Oxford	MMath	Multiple scales for discrete difference equations	Co-advised with C. Hall
2013–2014	Thomas Pettifor	Oxford	MMath	Discrete and continuum models for in vitro tissue growth	Co-advised with S. Waters
2013–2014	Melissa Varney	Oxford	MMath	Mathematical models for the wrinkling of thin sheets	Co-advised with D. Vella
2013–2014	Stephanie Yayoi Teramoto	Princeton	MMath	Stability of patterns in reaction-diffusion equations	Winner SIAM 2013 contest for Teaching Dynamical Systems
2011–2012	Rafael Y. Grinberg	Princeton	MMath	Topics in real analysis	Departmental thesis award
2011–2012	Daniel Wu	Princeton	BA Math	Functional analysis and applications to potential theory	