Panas Kalayanamit

Curriculum Vitae

Bangkok, Thailand
panas.kal@mahidol.ac.th

I am a mathematician working at Mahidol University, Thailand, specialised in mathematical analysis. My expertise lies in the theory of Partial Differential Equations (PDEs) and the Calculus of Variations, particularly elliptic PDEs and (quasi-)convex variational problems, which model the equilibrium or steady states of physical systems. I am very passionate about teaching mathematics, both to students of STEM disciplines and more general audiences.

My doctoral thesis focuses on the stability of solutions to minimization problems, especially in the calculus of variations and related PDEs. My current research focuses on the mathematical model of hyperelastic materials satisfying the neo-Hookean energy, which is the most widely applied energy in physics and engineering, using methods from the calculus of variations.

Most recently, I am working on combining techniques from Geometric Measure Theory with the Linking Number, an invariant from Differential Topology, to study the potential formation of cavities in media under external loads which may undergo discontinuous deformations. The success of this program would be an important step in helping to settle a long standing problem in nonlinear elasticity.

Work and Education

2026–present **Lecturer**, *Department of Mathematics, Faculty of Science*, Mahidol University, Thailand

2023–2025 **Postdoctoral Research**, *Mathematical Theory of Nonlinear Elasticity*, Universidad de O'Higgins, Chile
- Full-time research position, paid by the university
- Supervisor: Prof. Duvan Henao

2017–2022 **DPhil in Mathematics**, *EPSRC Centre for Doctoral Training in Partial Differential Equations – Analysis and Applications*, University of Oxford, United Kingdom
- Supervisor: Prof. Jan Kristensen
- Thesis: *Problem of Stability and Well-Posedness in the Calculus of Variations and related PDEs*

2016–2017 **MASt in Mathematics**, *Part III of the Mathematical Tripos*, University of Cambridge, United Kingdom
- Graduated with Merit

2012–2016 **BSc in Mathematics**, Chiang Mai University, Thailand
- Graduated with First Class Honours

Scholarships

2012–2022 *Development and Promotion of Science and Technology Talents (DPST)*, Institute for the Promotion of Teaching Science and Technology (IPST), Thailand

2009–2012 *Science Classrooms in University-affiliated School (SCiUS)*, affiliated with Chiang Mai University, Thailand

Publications

2025 P. Kalayanamit, *"Sobolev regularity of the inverse for minimizers of the neo-Hookean energy satisfying condition INV"*,
Proceedings of the Royal Society of Edinburgh: Section A Mathematics.
DOI: https://doi.org/10.1017/prm.2025.20

2026 D. Henao and P. Kalayanamit, *"The positivity of the Jacobian in the weak limit of generalised axisymmetric maps"*,
Nonlinear Analysis: Theory, Methods and Applications. (Corresponding Author)
DOI: https://doi.org/10.1016/j.na.2025.113972

- P. Kalayanamit, *"Generic Well-Posedness of Variational Integrals under Linear Perturbations"*,
in preparation
- P. Kalayanamit and J. Kristensen, *"Quasiconvexity and Growth Conditions"*,
in preparation
- P. Kalayanamit and J. Kristensen, *"Rectifiability of the Sets of Extremals for a Singularly Perturbed Quasiconvex Variational Integral"*,
in preparation
- D. Henao and P. Kalayanamit, *"Positivity of the Jacobian of the weak limit in the class of functions satisfying the divergence identities"*,
in preparation

Talks (invited speaker)

3 Feb 2022 *"On the Sets of Extremals for a Singularly Perturbed Variational Integral"*
– Analysis Seminar, University of Konstanz, Germany

14 Dec 2022 *"Generalized Functions in Modern PDEs and the Calculus of Variations Part I"*
– CMU Mathematics & Science Colloquium, Chiang Mai University, Thailand

19 Jan 2023 *"Generalized Functions in Modern PDEs and the Calculus of Variations Part II"*
– CMU Mathematics & Science Colloquium, Chiang Mai University, Thailand

20 Apr 2023 *"On the Sets of Extremals for a Singularly Perturbed Quasiconvex Integral"*
– XXXV Jornada de Matemática de la Zona Sur, Universidad de Concepción, Chile

31 Jul 2023 *"Non-Uniqueness, Regularity, and Stability in Vector Quasiconvex Problems"*
– Seminario de Cálculo de Variaciones y Ecuaciones en Derivadas Parciales, Universidad de O'Higgins, Chile

20 Dec 2023 *"Rectifiability of the Set of Minimizers for a Perturbed Quasiconvex Integral"*
– XCI Encuentro anual de la Sociedad de Matemática de Chile, Universidad de Chile, Chile

25 Apr 2024 *"Minimising the Neo-Hookean Energy Without Cavitation"*
– XXXVI Jornada de Matemática de la Zona Sur, Universidad Católica de Temuco, Chile

22 May 2025 *"Regularity of Deformations That Minimise the Neo-Hookean Energy"*
– Seminario de Cálculo de Variaciones y Ecuaciones en Derivadas Parciales, Universidad de O'Higgins, Chile
– Seminario de Análisis y Geometría, Pontificia Universidad Católica de Chile, Chile

Teaching Experience

2018-2022 TA/Tutor for undergraduate and MSc courses at the University of Oxford:

- MSc course:
  - *Further Partial Differential Equations*: (for Mathematical Modelling and Scientific Computing students) A course on practical methods for solving differential equations arising from applied science disciplines, which includes topics such as eigenfunction expansions, Sturm–Liouville theory, Green's function, Fourier/Laplace transforms and their applications, Hankel transforms and inversion formula, Mellin transforms and harmonic sums, and the applications of these methods to real problems.
- 1st year undergraduate courses:
  - *Constructive Mathematics*: (for Mathematics students) A course on mathematical algorithms for discrete problems and numerical analysis in optimisation, including topics such as division algorithm and Euclid's algorithm, linear Diophantine equations, polynomials and root-finding methods, bisection method, fixed point iteration, Newton's method and quasi-Newton method, Horner's method, systems of nonlinear equations and Newton's method for multivariable functions.
  - *Continuous Mathematics*: (for Computer Science students) A course on multivariable calculus, numerical analysis and their applications to problems in computer science such as machine learning and data processing. It includes topics such as partial differentiation, vector fields, Jacobian determinant, applications of Taylor's theorem, optimisation and constraints, loss functions, linear discriminant analysis, convexity, Lagrange multiplier, Karush–Kuhn–Tucker conditions, numerical methods for integration, error analysis, Monte Carlo integration, floating-point numbers, rates of convergence, root-finding algorithms (similar to the ones listed in Constructive Mathematics), and algorithms for optimisation (e.g. golden section search, gradient descend method and their convergence rates).
- 2nd year undergraduate courses:
  - *Integration*: (for Mathematics students) A course about Lebesgue's theory of measure and integration, containing topics such as measure spaces, the Lebesgue measure and Carathéodory's extension theorem, Cantor set, non-measurable sets, measurable functions and integration, product measures, Fubini–Tonelli's theorem, change of variables formula, and convergence in L^p spaces (e.g. Minkowski and Hölder inequalities, Egorov's theorem, and Riemann–Lebesgue lemma).
  - *Metric Spaces and Complex Analysis*: (for Mathematics students) The first half of this course is about the theory of metric spaces, which includes limits and continuity, isometries and homeomorphisms, general topological spaces, completeness, connnectedness, and compactness. The later half of this course contains topics in complex analysis such as geometry and topology of the complex plane, complex differentiation, holomorphic functions, Cauchy-Riemann equations, power series, multifunctions, path integration, Cauchy's theorems, Laurent's expansion, residue theorem, and conformal mappings.

- 3rd year undergraduate courses:

  - *Functional Analysis I*: (for Mathematics students) A course on foundational topics in functional analysis such as normed spaces and bounded linear operators, completeness and density, standard function spaces and Stone–Weierstrass theorem, the topologies of normed spaces and their dual spaces, Hahn–Banach theorem, and introductory spectral theory.

  - *Functional Analysis II*: (for Mathematics students) A course on more advanced topics in functional analysis such as linear operators on Hilbert spaces, Baire category theorem, Banach–Steinhaus theorem, open mapping theorem, closed graph theorem, weak convergence and weak compactness, modes of convergence for Fourier series, and spectral theory for linear operators on Hilbert spaces.

  - *Probability, Measure and Martingales*: (for Mathematics students) An advanced course on probability theory, containing topics such as measure theory in probability (e.g. σ-algebra, π-λ theorem, and Carathéodory's Extension Theorem), types of convergence of random variables, independence, expectation and conditional expectation, the L^p spaces, Jensen's inequality, and Radon–Nikodym theorem. The later part of this course focuses on martingales, which includes topics such as filtrations, stopping times, discrete stochastic integrals, Doob's theorems, uniform integrability, and Kolmogorov's strong law of large numbers.

Other Activities

2020 - present Acting as the admin of an online Thai mathematical community called "Any Maths-related Discussion" (translated from Thai) on social media, consisting of over 100,000 members. The group's aim is to facilitate mathematical discussions at all levels and to provide free guidance to struggling students or to anyone who has maths-related problems. I have also written a few articles and posted on this group.

2019 Acted as a grader for the Mathematics Admissions Test (MAT), the test used from 2007 to 2025 for Oxford admissions to Maths, Computer Science, or joint honours courses.

2018-2019 Helped with the grading of Oxford undergraduate exams.

2015 Served as an invigilator in the 56th International Mathematical Olympiad (IMO) that was held in Chiang Mai, Thailand.

2014 Organized the 33rd CMU Science Camp as the head of the mathematics group.

2011 Participated in the 8th Thailand Mathematical Olympiad (TMO) as one of the representatives from the northern region of Thailand.

2009–2016 Actively involved in organizing more than 20 "Integrated Science Camps" throughout the rural areas of Thailand. Together with people affiliated with CMU's Faculty of Science (professors, graduate and undergraduate students, and some high-school students from SCiUS program), we aim to promote scientific reasoning and critical thinking in underprivileged parts of the country. I was a chosen as a chair and co-chair, supervising the organizing of the camps, on more than three separate occasions.