

Benjamin M. Kent

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Experience

February 2024 – Present: Assegnista di Ricerca (Postdoctoral Researcher) at Istituto di Matematica Applicata e Tecnologie Informatiche “E. Magenes” (IMATI), Pavia, Italy

- Supervised by Lorenzo Tamellini. *IMATI* is a *Consiglio Nazionale delle Ricerche* (CNR) institute.
- Development of novel multi-fidelity surrogate modelling algorithm for use with “noisy” solvers.
- Focus on non-intrusive approximation via sparse grid methods and exploiting spectral polynomial approximation properties.
- Development of test cases including parametric elliptic and parabolic PDEs and using benchmark *Reynolds-Averaged Navier-Stokes* simulations. Collaboration with the Laboratori de Càlcul Numèric at *Universitat Politècnica de Catalunya*.
- Containerisation and deployment of research models via *Docker* and *Kubernetes*.

September 2019 – November 2023: PhD in Numerical Analysis at The University of Manchester, UK

- Supervised by Professor Catherine Powell and Professor David Silvester.
- Industry sponsored ICASE project with *IBM Research UK*.
- Thesis: *Efficient Approximation of Parametric Parabolic Partial Differential Equations*. [PDF]
- Investigated *adaptive-in-time sparse-grid stochastic collocation approximation* of a parametric time-dependent advection–diffusion problem.
- Focused on a combination of finite element method, adaptive timestepping and sparse polynomial approximation.
- Developed hierarchical and residual based error estimation strategies in the context of novel adaptive approximation algorithms.
- Also studied topics in *Functional Analysis, Approximation Theory and Finite Element Analysis, Adaptive Finite Element Methods, Uncertainty Quantification* (Monte Carlo, stochastic collocation, stochastic Galerkin methods) and *Bayesian inverse problems*.

September 2017 – August 2019: Algorithm Developer at Thales, Stockport, UK

- Development of array signal processing algorithm for time series sensor data.
- Analysis, evaluation and reporting for customer experiments.
- Collaboration with systems engineers to transform customer requirements to algorithm specifications.
- Collaboration with software engineers to implement algorithm specifications in products.

September 2015 – September 2017: Research Engineer at Thales, Reading, UK

- Two-year graduate scheme with training in both technical and core skills.
- Four project placements: cryptographic key exchange algorithms, radar signal processing algorithms, filtering, data fusion and tracking algorithms, array signal processing and experimental data analysis.

September 2012 – July 2015: Mathematics and Physics BSc, First-Class Honours at The University of Warwick, UK

- Prize for the **best exam results in my cohort**.

July 2014 – August 2014: Rules and Procedures Software Internship, Lloyd’s Register, Southampton, UK

- Upgrading FEM software components from FORTRAN to C++.

September 2010 – July 2012: The College of Richard Collyer, Horsham, UK

- A Levels: Mathematics A*, Further Mathematics A*, Physics A*, Chemistry A*, Electronics A*.
- GCSE: 10 A* (inc Maths and English) + 1 A (French).

Programming Experience

- MATLAB: Industrial algorithm development and data analysis. Research tool for investigations into the approximation of parametric partial differential equations.
- Julia: Implementation of novel PDE approximation algorithms and development of sparse grids approximation package *SparseGridsKit.jl*. Interfacing of Julia code with existing Python packages.
- Python: FEM approximation via *FEniCS* and *petsc4py*, design of model interfaces for containerisation.

- OpenFOAM and ParaView: Experience as a user for *Reynolds-Averaged Navier-Stokes* turbulence modelling including mesh generation, solver configuration, post processing and analysis.
- Docker and Kubernetes: Containerisation of software models via Docker and deployment via Kubernetes. Also have experience with SLURM systems.
- C / C++: Implementation of cryptographic key-exchange algorithms, development of industrial FEM software.
- Windows systems, Unix systems, version control systems and workflow automation, LaTeX.

Publications

- Seelinger, L., Reinarz, A., Lykkegaard, M.B., Akers, R., Alghamdi, A.M.A., Aristoff, D., Bangerth, W., Bénézech, J., Diez, M., Frey, K., Jakeman, J.D., Jørgensen, J.S., Kim, K.-T., Kent, B.M., Martinelli, M., Parno, M., Pellegrini, R., Petra, N., Riis, N.A.B., Rosenfeld, K., Serani, A., Tamellini, L., Villa, U., Dodwell, T.J., Scheichl, R.: Democratizing Uncertainty Quantification. *Journal of Computational Physics*. 113542 (2024). <https://doi.org/10.1016/j.jcp.2024.113542>
- Kent, B.M., Powell, C.E., Silvester, D.J., Zimoń, M.J.: Efficient Adaptive Stochastic Collocation Strategies for Advection–Diffusion Problems with Uncertain Inputs. *Journal of Scientific Computing*. 96, 64 (2023). <https://doi.org/10.1007/s10915-023-02247-w>
- Kent, B.M. Efficient Approximation of Parametric Parabolic Partial Differential Equations. PhD Thesis, University of Manchester (2024). [eThesis at Univeristy of Manchester]

In Preparation

- Kent, B. M., Tamellini, L., Giacomini, M., Huerta, A.: Multi-Fidelity Surrogate Modelling for “Noisy” Solvers via a Novel Multi-Index Stochastic Collocation Algorithm.

Conference Organisation

- *Co-organiser*: Minisymposium on *Approximating complex systems: Surrogates, reduced order modelling and dimension reduction*, 30th Biennial Numerical Analysis Conference, June 2025.
- *Co-organiser*: Minisymposium on *Adaptive sampling and surrogate/reduced order modelling strategies for parametric differential equations*, XII International Conference on Adaptive Modeling and Simulation (ADMOS), June 2025.
- *Co-organiser*: Manchester Mathematics Research Student Conference online conference, 2020.
- *Co-organiser*: Mathematics of Data Science online student conference, 2020.

Conference Talks and Seminars

- Sandia National Laboratories, March 2025. *Multi-Index Stochastic Collocation for PDEs with Imperfect Solvers*.
- SIAM Conference on Computational Science and Engineering, March 2025. *Multi-Index Stochastic Collocation for PDEs with Imperfect Solvers*.
- UM-Bridge Workshop, December 2024. *An UM-Bridge-based setup for multi-fidelity surrogate models for UQ (invited talk)*. [PDF] [YouTube]
- CNR-IMATI Internal Conference, November 2024. *Multi-fidelity Approach for Uncertainty Quantification of a Fluid Dynamics NASA Test Case*.
- Workshop on Frontiers of Uncertainty Quantification, September 2024. *Adaptive Stochastic Collocation for Parametric Parabolic PDEs*.
- Very Informal Seminar Series, University of Pavia, May 2024. *Computationally Efficient Approximation of Parametric Partial Differential Equations*.
- 29th Biennial Numerical Analysis Conference, June 2023. *Adaptive in Time Approximation of Parametric Parabolic PDEs*.
- Manchester SIAM-IMA Student Chapter Conference, April 2023. *Adaptive in Time Approximation of Parametric Parabolic PDEs (Best Student Talk Prize Winner)*. [PDF]
- SIAM Conference on Computational Science and Engineering, February 2023. *Efficient Adaptive Stochastic Collocation Strategies for Advection-Diffusion Problems with Uncertain Inputs*.
- SIAM UKIE National Student Chapter Conference, June 2022. *Error Estimation for Stochastic Collocation Approximation of Parametric Advection–Diffusion Problems*.
- IBM Research UK, April 2022. *Efficient Approximation of Parametric Parabolic PDEs (invited seminar)*.
- SIAM Conference on Uncertainty Quantification, April 2022. *A Posteriori Error Estimation for Stochastic Collocation Applied to Parametric Parabolic PDEs*.
- 26th Annual Meeting of SIAM UKIE Section, January 2022. *A Posteriori Error Estimation for Stochastic Collocation Applied to Parametric Parabolic PDEs*.

Teaching Experience

- University of Manchester: Teaching assistant for Matrix Analysis MATH36001 (semester one, 2021), Mathematical Workshop (MATH10001, semester one, 2021), for Complex Analysis MATH20142 (semester two, 2020).