Davide Pradovera

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Born on October 9, 1993 in Piacenza, Italy.
Nationality: Italian.

Current position

Post-doctoral researcher, KTH.

Areas of specialization

Numerical mathematics for partial differential equations, approximation theory, model order reduction, frequency-domain applications, scattering problems.

Appointments held

2014–2017 [*Special courses teacher*, Piacenza (IT).
2016 [*Developer intern*, Iren SpA, Piacenza (IT).
2017–2021 [*Doctoral assistant*, EPFL, Lausanne (CH).
2022 [*Post-doctoral researcher*, EPFL, Lausanne (CH).
2022–2024 [*University assistant and post-doctoral researcher*, University of Vienna, Vienna (AT).
2024–now [*Post-doctoral researcher*, KTH, Stockholm (SE).

Education

2012–2015 [BSc in Applied Mathematics (*cum laude*), Politecnico di Milano, Milan (IT).
Thesis: "A mathematical justification of the momentum operator in quantum mechanics".
Advisor: Prof. M. Verri.

2015–2017 [MSc in Computational Science and Engineering, EPFL, Lausanne (CH).
Project: "Implementation of smooth contact mechanics with the mortar method".
Advisor: Prof. G. Anciaux.
Project: "Finite elements-based Padé approximants for Helmholtz frequency response problems".
Advisor: Prof. F. Nobile.
Thesis: "Randomized low-rank approximation of matrices and tensors".
Advisor: Prof. D. Kressner.

2017–2021 [PhD in Mathematics, EPFL, Lausanne (CH).
Thesis: "Model order reduction based on functional rational approximants for parametric PDEs with meromorphic structure". Advisor: Prof. F. Nobile.

Grants, honors, and awards

2011 [3rd place at the "Hong Kong International Science Fair".
2013 [4th place in the "Championnat International des Jeux Mathématiques et Logiques".
2014 [5th place in the "Championnat International des Jeux Mathématiques et Logiques".
2017 [Douchet prize for best GPA, MATH-EPFL.
2020 [Prize for exceptional teaching service, Section of Mathematics, EPFL.
2021 [Junior Research Fellowship at ESI Vienna.

Publications

Journal articles

2019 [F. Bonizzoni and DP, "Distributed sampling for rational approximation of the acoustic scattering of an airfoil", PAMM 19.
2020 [F. Bonizzoni, F. Nobile, I. Perugia, and DP, "Fast Least-Squares Padé approximation of problems with normal operators and meromorphic structure", Math. Comput. 89.
F. Bonizzoni, F. Nobile, I. Perugia, and DP, "Least-Squares Padé approximation of parametric and stochastic Helmholtz maps", Adv. Comput. Math. 46.
[DP, "Interpolatory minimal rational model order reduction of parametric problems lacking uniform inf-sup stability", SIAM J. Numer. Anal. 58.
2021 [F. Bonizzoni and DP, "Shape optimization for a noise reduction problem by non-intrusive parametric reduced modeling", Proc. WCCM-ECCOMAS2020.
DP and F. Nobile, "Frequency-domain non-intrusive greedy Model Order Reduction based on minimal rational approximation", Sci. Comput. Electr. Eng. 36.
[F. Nobile and DP, "Non-intrusive double-greedy parametric model reduction by interpolation of frequency-domain rational surrogates", ESAIM:M2AN 55.
2022 [DP and F. Nobile, "A technique for non-intrusive greedy piecewise-rational model reduction of frequency response problems over wide frequency bands", J. Math. Ind. 12.
2023 [F. Bonizzoni, DP, and M. Ruggeri, "Rational-approximation-based model order reduction of Helmholtz frequency response problems with adaptive finite element snapshots", Math. Eng. 5.
DP, "Adaptive approximation of nonlinear eigenproblems by minimal rational interpolation", PAMM 22.
[DP, "Toward a certified greedy Loewner framework with minimal sampling", Adv. Comput. Math. 49.
2024 [P. Huwiler, DP, and J. Schiffmann, "Plug-and-play adaptive surrogate modeling of parametric nonlinear dynamics in frequency domain", Int. J. Num. Meth. Eng. 125.
[DP and A. Borghi, "Match-based solution of general parametric eigenvalue problems", J. Comp. Phys. 519.

Pending articles

2023 DP, M. Nonino, and I. Perugia, "Geometry-based approximation of waves in complex domains", under review.

2024 DP, I. V. Gosea, and J. Heiland, "Barycentric rational approximation for learning the index of a dynamical system from limited data", under review.

Talks and attendance at events

Presentations at conferences

2019 DP, F. Nobile, F. Bonizzoni, and I. Perugia, "A technique for rational model order reduction of parametric problems lacking uniform inf-sup stability", GAMM Annual Meeting 2019, Vienna (AT).

DP, F. Nobile, F. Bonizzoni, and I. Perugia, "A technique for rational model order reduction of parametric problems lacking uniform inf-sup stability", ICIAM 2019, Valencia (ES).

DP and F. Nobile, "Interpolatory rational model order reduction of parametric problems lacking uniform inf-sup stability", ENUMATH 2019, Egmond aan Zee (NL).

2021 DP, F. Nobile, and F. Bonizzoni, "Non-intrusive model reduction of parametric frequency response problems via minimal rational interpolation", ICOSAHOM 2020/2021 (virtual), Vienna (AT).

DP and F. Nobile, "Non-intrusive model reduction of parametric frequency-response problems – with applications to UQ", SIMAI 2020+2021, Parma (IT).

2022 DP and F. Nobile, "Non-intrusive surrogate modeling of parametric frequency response problems – With applications in forward UQ", SIAM UQ22 (virtual), Atlanta (Georgia, US).

DP and F. Nobile, "Inexpensive surrogate modeling of frequency response problems by greedy minimal rational interpolation", GAMM Annual Meeting 2022, Aachen (DE).

DP and F. Nobile, "Non-intrusive surrogate modeling of frequency response surfaces via locally adaptive sparse grids", GIMC SIMAI Young 2022, Pavia (IT).

2023 DP, M. Nonino, and I. Perugia, "Geometry-based approximation of waves propagating through complex domains", 17th Austrian Numerical Analysis Day, Vienna (AT).

DP, F. Nobile, and A. Borghi, "Non-intrusive surrogate modeling of parametric frequency-response problems", Math2Product 2023, Taormina (IT).

DP, "Rational approximation with minimal sampling for Helmholtz-like problems", ILAS 2023, Madrid (ES).

DP, F. Nobile, and A. Borghi, "Data-driven adaptive approximation of parametric dynamical systems with pole bifurcations", ENUMATH 2023, Lisbon (PT).

2024 DP, F. Nobile, and A. Borghi, "Adaptive collocation-based approximation of parametric nonlinear eigenproblems", SIAM UQ24, Trieste (IT).

DP and A. Borghi, "Adaptive collocation-based approximation of parametric nonlinear eigenproblems", ECM 2024, Seville (ES).

Posters

2018 F. Bonizzoni, I. Perugia, F. Nobile, and DP, "An efficient algorithm for Padé-type approximation of the frequency response for the Helmholtz problem", MoRePaS IV, Nantes (FR).

F. Bonizzoni, I. Perugia, F. Nobile, and DP, "An efficient algorithm for Padé-type approximation of the frequency response for the Helmholtz problem", Swiss Numerics Day 2018, Zurich (CH).

2020 DP and F. Nobile, "Frequency-domain non-intrusive greedy Model Order Reduction based on minimal rational approximation", SCEE 2020, Eindhoven (NL).

DP and F. Nobile, "Frequency-domain non-intrusive greedy Model Order Reduction based on minimal rational approximation", MORSS 2020 (virtual), Lausanne (CH).

2022 DP and F. Nobile, "Non-intrusive adaptive surrogate modeling of parametric frequency-response problems", MORe 2022, Berlin (DE).

Other talks and seminars

2018 DP, F. Nobile, F. Bonizzoni, and I. Perugia, "Fast Least-Squares Padé approximation of self-adjoint problems with meromorphic structure", seminar, MATHICSE retreat, Sainte-Croix (CH).

DP, F. Nobile, F. Bonizzoni, and I. Perugia, "Fast Least-Squares Padé approximation of self-adjoint problems with meromorphic structure", workshop talk, DRWA, Alba di Canazei (IT).

2019 DP and F. Nobile, "Polynomial approximation of resonance manifolds", short seminar, MATHICSE retreat, Champéry (CH).

2020 DP, "Padé approximation: a quick overview", seminar (virtual), CSQI talks, Lausanne (CH).

DP, "From Padé approximation to rational interpolation", seminar (virtual), CSQI talks, Lausanne (CH).

DP, "Minimal rational approximation", seminar (virtual), CSQI talks, Lausanne (CH).

DP, "Minimal rational approximation: a model reduction tool for parametrized PDEs with resonances", seminar (virtual), PDE afternoons, Vienna (AT).

2021 DP, "Matching-based pMOR for dynamical systems", seminar (virtual), CSQI talks, Lausanne (CH).

2022 DP, "Surrogate modeling of parametric frequency response problems via locally adaptive sparse grids", workshop talk, "Approximation of high-dimensional parametric PDEs in forward UQ" ESI workshop, Vienna (AT).

DP, "Can reliable surrogate models for frequency-domain problems be both non-intrusive and cheap to build?", workshop talk, "UQ in kinetic and transport equations and in high-frequency wave propagation" ESI workshop, Vienna (AT).

2023 DP, "Efficient and adaptive rational approximation for parametric dynamical systems", seminar, CSC seminar, Magdeburg (DE).

2024 DP, "Adaptive data-driven surrogate modeling of parametric nonlinear eigenproblems", seminar, NA seminar, KTH, Stockholm (SE).

Attended events

2018 "Numerical Analysis of Complex PDE Models in the Sciences" ESI workshop, Vienna (AT).

2021 Swiss Numerics Day 2021, Lausanne (CH).

2022 "Adaptivity, High Dimensionality and Randomness" ESI workshop, Vienna (AT).

Austrian Numerical Analysis Day 2022, Linz (AT).

MCQMC 2022, Linz (AT).

2023 "Canonical scattering problems" INI workshop, Cambridge (GB).

2nd SFB International Workshop 2023, Vienna (AT).

2024 "Celebrating Zhaojun Bai's honorary doctorate" workshop, Stockholm (SE).
5th Workshop on Scientific Computing in Sweden, Stockholm (SE).

Teaching experience

2017–2021 As teaching assistant at EPFL (preparation of course and exercise material, preparation and grading of assignments and exams):
- 2017 Analyse avancée I, BSc in Mathematics.
- 2018 Analyse numerique, BSc in Mechanical Engineering.
- 2018 Analyse fonctionnelle, BSc in Mathematics.
- 2019 Introduction to partial differential equations, BSc in Mathematics.
- 2021 Numerical analysis and computational mathematics, MSc in Computational Sciences and Engineering.
- 2019–2021 Parallel and high-performance computing, MSc in Computational Sciences and Engineering.

2022 Invited lecturer for: Numerical methods for random PDEs and uncertainty, PhD course, EPFL.
2022–2023 As university assistant at U Vienna (charged with the organization of the whole course):
- 2022–2023 Exercises of Analysis and Linear Algebra 1, BSc in Mathematics.
- 2023 Topics in Finite Elements, MSc in Mathematics.
- 2023 Exercises of Applied Mathematics, BSc Teacher Training Program in Mathematics.
- 2023 Exercises of Numerical Mathematics, BSc in Mathematics.

Teaching education

2023 "When to Teach What? - Sequencing Course Content and Assignments", Center for Teaching and Learning, University of Vienna.
"(Unconscious) Bias at the University", Center for Training and Development, University of Vienna.
"Introduction to Active Learning", Center for Teaching and Learning, University of Vienna.

Other service

2019 Supervision of BSc thesis: "Approximation numérique du spectre des opérateurs elliptiques d'ordre deux" by T. Chanay, EPFL.
2020 Organizer of the Model Order Reduction Summer School 2020 (virtual event).
Referee for scientific journals: "Advances in Computational Mathematics".
2022 Supervision of MSc project: "Minimal rational approximation for time-harmonic Maxwell's equations" by F. Matti, EPFL.
Referee for scientific journals: "Journal of Computational Physics".
2023 Chairperson for "Data-driven reduced order modelling and surrogates with applications in complex multi-physics systems" mini-symposium at M2P 2023.
Organizer of the "Reducing the irreducible: model reduction for transport-dominated problems" mini-symposium at ENUMATH 2023.
Referee for scientific journals: "Advances in Computational Mathematics", "Computational Methods in Applied Mathematics", "Journal of Computational Physics", "Inverse Problems", and "SIAM Journal of Scientific Computing".

2024 Organizer of the "Methods for stochastic/parametric frequency-domain and spectral problems" mini-symposium at SIAM UQ24.

Referee for scientific journals: "Advances in Computational Mathematics", "Applied Mathematics Letters", "Computational Methods in Applied Mathematics", and "Mathematics and Computers in Simulation".

2024–now Editorial board member of "Examples and Counterexamples".

Computer skills

Advanced MATLAB, C/C++, OpenMP, MPI, Python, LaTeX.

Intermediate CUDA, C#, FreeFem++, HTML, CSS.

Basic R, OpenFOAM, Fluent, Fortran, Java.

Languages

Italian:	Native	English:	Fluent
French:	Intermediate	Spanish:	Intermediate
German:	Basic	Swedish:	Basic