

# PETAR MLINARIĆ

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## EXPERIENCE

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### University of Zagreb

*Assistant professor*

Mar 2025–present

*Zagreb, Croatia*

- Assistant professor at the Faculty of Science, Department of Mathematics.

### Virginia Tech

*Postdoctoral associate*

Sep 2021–Dec 2024

*Blacksburg, VA, United States*

- Postdoctoral Associate in the Department of Mathematics at Virginia Tech.
- Developing data-driven, optimization-based, reduced-order modeling methods.
- Contributing to the pyMOR package.

### Max Planck Institute for Dynamics of Complex Technical Systems

*Research assistant, postdoctoral researcher*

Sep 2014–Jul 2021

*Magdeburg, Germany*

- Started as a Ph.D. student at the Otto von Guericke University of Magdeburg and the graduate program “International Max Planck Research School (IMPRS) for Advanced Methods in Process and Systems Engineering (Magdeburg)”.
- In January 2020, defended the Ph.D. thesis titled “Structure-preserving model order reduction for network systems”, supervised by Prof. Dr. Peter Benner.
- Contributed to the pyMOR package since 2015, became a maintainer in September 2016.
- From January 2019, working within the “pyMOR—Sustainable Software for Model Order Reduction” project under the DFG call “Sustainability of Research Software”.
- Co-supervised three undergraduate students contributing to pyMOR.

## EDUCATION

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### Otto von Guericke University of Magdeburg, *Ph.D. in Applied Mathematics*

Oct 2014–Jan 2020

Thesis: Structure-Preserving Model Order Reduction for Network Systems

Supervisor: Prof. Dr. Peter Benner

### University of Zagreb, *M.Sc. in Applied Mathematics*

Oct 2012–Jul 2014

Thesis: Approximation of Linear Dynamical Systems in  $\mathcal{H}_2^{p \times m}(\mathbb{C}_+)$

Supervisor: Prof. Dr. Zlatko Drmač

### University of Zagreb, *B.Sc. in Mathematics*

Oct 2009–Jul 2012

## PREPRINTS

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G. Olikier, P. Mlinarić, P.-A. Absil, and A. Uschmajew, The tangent cone to the real determinantal variety: various expressions and four proofs, *submitted*, April 2025

P. Mlinarić, P. Benner, and S. Gugercin, Interpolatory necessary optimality conditions for reduced-order modeling of parametric linear time-invariant systems, *submitted*, January 2024

## JOURNAL PUBLICATIONS

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J.M. Maldonado, C. Drischler, R.J. Furnstahl, and P. Mlinarić, Greedy emulators for nuclear two-body scattering, *Physical Review C*, August 2025

P. Mlinarić, P. Benner, and S. Gugercin, Interpolatory  $\mathcal{H}_2$ -optimality conditions for structured linear time-invariant systems, *SIAM Journal on Numerical Analysis*, April 2025

P. Mlinarić, C. A. Beattie, Z. Drmač, and S. Gugercin, IRKA is a Riemannian gradient descent method, *IEEE Transactions on Automatic Control (Early Access)*, November 2023

P. Mlinarić and S. Gugercin, A unifying framework for interpolatory  $\mathcal{L}_2$ -optimal reduced-order modeling, *SIAM Journal on Numerical Analysis*, September 2023

P. Mlinarić and S. Gugercin,  $\mathcal{L}_2$ -optimal reduced-order modeling using parameter-separable forms, *SIAM Journal on Scientific Computing*, April 2023

M. Hund, T. Mitchell, P. Mlinarić, and J. Saak, Optimization-based parametric model order reduction via  $\mathcal{H}_2 \otimes \mathcal{L}_2$  first-order necessary conditions, *SIAM Journal on Scientific Computing*, June 2022

H.-J. Jongsma, P. Mlinarić, S. Grundel, P. Benner, and H. L. Trentelman, Model reduction of linear multi-agent systems by clustering with  $\mathcal{H}_2$  and  $\mathcal{H}_\infty$  error bounds, *Mathematics of Control, Signals, and Systems*, April 2018

## BOOK CHAPTERS

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P. Benner, S. Grundel, and P. Mlinarić, Clustering-based model order reduction for nonlinear network systems, In: P. Benner, T. Breiten, H. Faßbender, M. Hinze, T. Stykel, R. Zimmermann (eds), *Model Reduction of Complex Dynamical Systems*, August 2021

P. Mlinarić, S. Rave, and J. Saak, Parametric model order reduction using pyMOR, In: P. Benner, T. Breiten, H. Faßbender, M. Hinze, T. Stykel, R. Zimmermann (eds), *Model Reduction of Complex Dynamical Systems*, August 2021

## CONFERENCE PROCEEDINGS PUBLICATIONS

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P. Mlinarić, Z. Sokolij, G. Talla, U. Meyer-Baese, A. Stadlbauer, H. Malberg, C.-H. Na, K. Juetten, B. Wiestler, and A. Meyer-Baese, Clustering-based model reduction for glioma graph networks, In: B.S. Gimi, A. Krol (eds), *Medical Imaging 2025: Clinical and Biomedical Imaging*, April 2025

L. Balicki, P. Mlinarić, S. Rave, and J. Saak, System-theoretic model order reduction with pyMOR, *Proceedings in Applied Mathematics and Mechanics*, November 2019

M. Hund, P. Mlinarić, and J. Saak, An  $\mathcal{H}_2 \otimes \mathcal{L}_2$ -optimal model order reduction approach for parametric linear time-invariant systems, *Proceedings in Applied Mathematics and Mechanics*, December 2018

P. Mlinarić, T. Ishizaki, A. Chakraborty, S. Grundel, P. Benner, and J. Imura, Synchronization and aggregation of nonlinear power systems with consideration of bus network structures, *Proceedings of the European Control Conference (ECC)*, June 2018

P. Benner, S. Grundel, and P. Mlinarić, Stability preserving model reduction for linearly coupled linear time-invariant systems, *Proceedings in Applied Mathematics and Mechanics*, October 2016

P. Mlinarić, S. Grundel, and P. Benner, Clustering-based model order reduction for multi-agent systems with general linear time-invariant Agents, *Proceedings of the 22<sup>nd</sup> International Symposium on Mathematical Theory of Networks and Systems (MTNS)*, July 2016

P. Mlinarić, S. Grundel, and P. Benner, Efficient model order reduction for multi-agent systems using QR decomposition-based clustering, *Proceedings of the 54<sup>th</sup> IEEE Conference on Decision and Control*, December 2015

## PROFESSIONAL SERVICE

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**pyMOR School and User Meeting 2024 co-organizer** 26–30 Aug 2024  
The sixth pyMOR School, taking place at U Münster (<https://2024.school.pymor.org/>).

**pyMOR School 2023 co-organizer** 18–22 Sep 2023  
The fifth pyMOR School, taking place at TU Berlin (<https://2023.school.pymor.org/>).

**SIAM Southeastern Atlantic Section minisymposium co-organizer** 25–26 Mar 2023  
A minisymposium at the SIAM SEAS23 conference in Blacksburg, US.

**SIAM CSE23 pyMOR minitutorial co-organizer** 1 Mar 2023  
A pyMOR minitutorial at the SIAM CSE23 conference in Amsterdam, The Netherlands.

**SIAM CSE23 minisymposium co-organizer** 26 Feb–3 Mar 2023  
A minisymposium at the SIAM CSE23 conference in Amsterdam, The Netherlands.

**pyMOR School 2022 co-organizer** 22–26 Aug 2022  
The fourth pyMOR School, taking place at MPI Magdeburg (<https://2022.school.pymor.org/>).

**Virginia Tech Department of Mathematics seminar organizer** Aug 2022–Apr 2024  
Organized the Applied Numerical Analysis seminar at the Department of Mathematics at Virginia Tech.

**Virginia Tech Postdoctoral Association board member** May 2022–Jul 2024  
Held positions as secretary (2022/23) and communications officer (2023/24).

**pyMOR School 2021 co-organizer** 4–8 Oct 2021  
The third pyMOR School, taking place at WWU Münster (<https://2021.school.pymor.org/>).

**pyMOR Online Course 2020 co-organizer** 28 Sep–2 Oct 2020  
The second pyMOR School in an online format (<https://2020.school.pymor.org/>).

**SAMM 2020 co-organizer** 27–31 Jul 2020  
The 7<sup>th</sup> GAMM Juniors’ Summer School on Applied Mathematics and Mechanics (SAMM) with the topic “Learning Models from Data: Model Reduction, System Identification and Machine Learning” (<https://www.mpi-magdeburg.mpg.de/csc/events/samm20>).

**pyMOR School 2019 co-organizer** 7–11 Oct 2019  
The first pyMOR School, taking place at MPI Magdeburg (<https://2019.school.pymor.org/>).

Held positions as president (2015/16) and secretary (2016/17).

### Reviewer

Applied Mathematics Modeling, Applied Mathematics and Computation, Automatica, Computer Methods in Applied Mechanics and Engineering, European Control Conference, European Journal of Control, GAMM Archive for Students, IEEE Conference on Decision and Control, IEEE Control Systems Letters, IEEE Transactions on Automatic Control ( $\times 5$ ), International Symposium on Mathematical Theory of Networks and Systems, Journal of Applied Mathematics and Mechanics, Journal of Computational Physics, Journal of Computational and Applied Mathematics, MDPI Mathematics ( $\times 3$ ), Mathematical Communications, SIAM Journal on Control and Optimization, SIAM Journal on Mathematics of Data Science, SIAM Journal on Matrix Analysis and Applications, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing ( $\times 2$ ), SoftwareX, Systems & Control Letters ( $\times 4$ ), Transactions on Mathematical Software.

## TEACHING EXPERIENCE

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### Otto von Guericke University of Magdeburg

Model Order Reduction of Dynamical Systems (Summer 2017, exercises)

### Virginia Tech

Math 2114: Introduction to Linear Algebra (Spring 2022, Spring 2023)

Math 4445: Introduction to Numerical Analysis (Spring 2024)

## RESEARCH VISITS AND TRAININGS

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### Josip Juraj Strossmayer University of Osijek

12–16 Sep 2022

Visited Prof. Dr. Zoran Tomljanović for one week.

### Josip Juraj Strossmayer University of Osijek

17–23 Dec 2021

Visited Prof. Dr. Zoran Tomljanović for one week within an ERASMUS+ project.

### ICERM semester program

27 Jan–1 May 2020

Participated in the semester program “Model and dimension reduction in uncertain and dynamic systems” (<https://icerm.brown.edu/programs/sp-s20/>).

### Groningen Autumn School on Model Order Reduction

30 Oct–2 Nov 2017

Participated in the fall school in Groningen, The Netherlands.

### Tokyo Institute of Technology

7 Jul–15 Sep 2017

Visited Prof. Dr. Jun-ichi Imura’s research group for two months.

### University of Groningen

20–21 Jan 2016

Visited Prof. Dr. Harry Trentelman for two days.

### The Third International School on Model Reduction for Dynamical Control Systems

5–9 Oct 2015

Participated in the summer school in Dubrovnik, Croatia.

### 7<sup>th</sup> Elgersburg School

1–7 Mar 2015

Participated in the winter school in Elgersburg, Germany.

### DAAD International School on Linear Optimal Control of Dynamic Systems

23–28 Sep 2013

Participated in the summer school in Osijek, Croatia.

## AWARDS

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### GAMM Junior

2017–2020

Three-year position awarded yearly to ten young academics working in the field of applied mathematics and mechanics (<https://www.gamm-juniors.de/>).

## INVITED MINISYMPOSIUM TALKS

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### 26<sup>th</sup> International Symposium on Mathematical Theory of Networks and Systems (MTNS 2024), Cambridge, UK

19–23 Aug 2024

*TF-IRKA is also a Riemannian Gradient Descent Method*

### European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 2023), Lisbon, Portugal

4–8 Sep 2023

*Parametric Reduced-order Modeling via Nonlinear Least Squares*

### 25<sup>th</sup> Conference of the International Linear Algebra Society (ILAS 2023), Madrid, Spain

12–16 Jun 2023

*Optimal Reduced-order Modeling for Structured Linear Systems*

<b>SIAM Conference on Computational Science and Engineering (CSE23)</b> , Amsterdam, The Netherlands <i>Least-squares Parametric Reduced-order Modeling</i>	26 Feb–3 Mar 2023
<b>5<sup>th</sup> Annual Meeting of the SIAM Texas-Louisiana Section (SIAM TXLA22)</b> , Houston, TX, USA <i>Least-squares Parametric Reduced-order Modeling</i>	4–6 Nov 2022
<b>SIAM Conference on Control and Its Applications (CT21)</b> , virtual <i>Clustering-Based Model Order Reduction for Water Networks</i>	19–21 Jul 2021
<b>European Control Conference (ECC18)</b> , Limassol, Cyprus <i>Synchronization and Aggregation of Nonlinear Power Systems with Consideration of Bus Network Structures</i>	12–15 Jun 2018
<b>22<sup>nd</sup> International Symposium on Mathematical Theory of Networks and Systems (MTNS 2016)</b> , Minneapolis, MN, USA <i>Clustering-Based Model Order Reduction for Multi-Agent Systems with General Linear Time-Invariant Agents</i>	12–15 Jul 2016

## CONFERENCE AND WORKSHOP TALKS

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<b>Challenges, Opportunities, and New Horizons in Rational Approximation</b> , Banff, Canada <i>Riemannian Optimization over Rational Functions</i>	6–11 Apr 2025
<b>4<sup>th</sup> Workshop on Optimal Control of Dynamical Systems and Applications</b> , Villány, Hungary <i>Optimal Damping for the Wave Equation</i>	26–28 Feb 2025
<b>Model Reduction and Surrogate Modeling (MORE2024)</b> , San Diego, USA <i>Riemannian Optimization over the Manifold of Rational Functions</i>	9–13 Sep 2024
<b>Nonlinear Model Reduction for Control</b> , Blacksburg, VA, USA <i><math>\mathcal{H}_2 \otimes \mathcal{L}_2</math>-optimal Model Order Reduction for Quadratic-bilinear Systems</i>	22–26 May 2023
<b>SIAM Southeastern Atlantic Section Annual Meeting</b> , Blacksburg, VA, USA <i><math>\mathcal{L}_2</math>-optimal Reduced-order Modeling of Parametric Stationary Problems</i>	25–26 Mar 2023
<b>Model Reduction and Surrogate Modeling (MORE)</b> , Berlin, Germany <i>Structured <math>\mathcal{L}_2</math>-Optimal Parametric Model Order Reduction</i>	19–23 Sep 2022
<b>11<sup>th</sup> Conference on Applied Mathematics and Scientific Computing (ApplMath22)</b> , Brijuni, Croatia <i>Iterative Rational Krylov Algorithm and Riemannian Optimization</i>	5–9 Sep 2022
<b>New Trends in Computational Science in Engineering and Industrial Mathematics</b> , Magdeburg, Germany <i>Is IRKA a Riemannian Optimization Method?</i>	1–2 Jul 2022
<b>Spring 2020 Reunion Event</b> , Providence, RI, USA <i><math>\mathcal{L}_2</math>-Optimal Reduced-Order Modeling</i>	23 May–10 Jun 2022
<b>SIAM Conference on Uncertainty Quantification (UQ22)</b> , Atlanta, GA, USA <i><math>\mathcal{L}_2</math>-Optimal Model Order Reduction for Parametric Stationary Problems</i>	12–15 Apr 2022
<b>3<sup>rd</sup> Workshop on Optimal Control of Dynamical Systems and Applications</b> , Osijek, Croatia <i>Structured <math>\mathcal{L}_2</math>-Optimal Parametric Model Order Reduction</i>	28 Mar–1 Apr 2022
<b>Tenth Conference on Applied Mathematics and Scientific Computing (ApplMath20)</b> , Brijuni, Croatia <i>Optimization-Based Parametric Model Order Reduction via Wilson-Type <math>\mathcal{H}_2 \otimes \mathcal{L}_2</math> Conditions</i>	14–18 Sep 2020
<b>4<sup>th</sup> Workshop on Model Reduction of Complex Dynamical Systems (MODRED 2019)</b> , Graz, Austria <i>Clustering-Based Model Order Reduction for Nonlinear Network Systems</i>	28–30 Aug 2019
<b>90<sup>th</sup> GAMM Annual Meeting</b> , Vienna, Austria <i><math>\mathcal{H}_2</math>-Optimal Model Order Reduction of Interconnected Systems</i>	18–22 Feb 2019
<b>International Workshop on Optimal Control of Dynamical Systems and Applications</b> , Osijek, Croatia <i><math>\mathcal{H}_2</math>-Optimal Model Order Reduction for Port-Hamiltonian Systems</i>	20–22 Jun 2018
<b>Model Reduction of Parameterized Systems IV (MoRePaS 2018)</b> , Nantes, France <i><math>\mathcal{H}_2</math>-Optimal Structure-Preserving Model Order Reduction for Second-Order Systems</i>	10–13 Apr 2018

<b>89<sup>th</sup> GAMM Annual Meeting</b> , Munich, Germany <i>Clustering-Based Model Order Reduction for Nonlinear Multi-Agent Systems</i>	19–23 Mar 2018
<b>Reduced Basis (and Friends) Summer School 2017</b> , Goslar, Germany <i>H<sub>2</sub>-Optimal Model Order Reduction and Reduced Basis Methods</i>	19–22 Sep 2017
<b>88<sup>th</sup> GAMM Annual Meeting</b> , Weimar, Germany <i>H<sub>2</sub>-Optimal Model Order Reduction for Second Order Systems</i>	6–10 Mar 2017
<b>3<sup>rd</sup> Workshop on Model Reduction of Complex Dynamical Systems (MODRED 2017)</b> , Odense, Denmark <i>Model Reduction of Network Systems by Clustering</i>	11–13 Jan 2017
<b>Reduced Basis Summer School 2016</b> , Hedersleben, Germany <i>Model Order Reduction for Multi-Agent Systems</i>	4–7 Oct 2016
<b>Workshop on Model Reduction Methods and Optimization</b> , Opatija, Croatia <i>Almost Almost-Equitableness and Clustering-Based Error Bounds</i>	20–21 Sep 2016
<b>6<sup>th</sup> Croatian Mathematical Congress</b> , Zagreb, Croatia <i>Clustering-Based Model Order Reduction for Multi-Agent Systems</i>	14–17 Jun 2016
<b>Joint Annual Meeting of DMV and GAMM</b> , Braunschweig, Germany <i>Stability Preserving Model Reduction for Linearly Coupled Linear Time-Invariant Systems</i>	7–11 Mar 2016
<b>10<sup>th</sup> Elgersburg Workshop</b> , Elgersburg, Germany <i>Efficient Model Order Reduction for Multi-Agent Systems Using Graph Partitions</i>	7–11 Feb 2016
<b>54<sup>th</sup> IEEE Conference on Decision and Control (CDC)</b> , Osaka, Japan <i>Efficient Model Order Reduction for Multi-Agent Systems Using QR Decomposition-Based Clustering</i>	15–18 Dec 2015
<b>Reduced Basis Summer School 2015</b> , Hegne, Germany <i>Efficient Model Order Reduction for Multi-Agent Systems Using Graph Partitions</i>	14–18 Sep 2015

## TALKS AT INSTITUTIONS

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<b>Applied Numerical Analysis Seminar, Virginia Tech</b> , Blacksburg, VA, USA <i>What is the Optimal Damper Position for the Wave Equation?</i>	13 Oct 2023
<b>Applied Numerical Analysis Seminar, Virginia Tech</b> , Blacksburg, VA, USA <i>Optimal Reduced-order Modeling of Structured Linear Systems</i>	24 Mar 2023
<b>Applied Numerical Analysis Seminar, Virginia Tech</b> , Blacksburg, VA, USA <i>Is IRKA a Riemannian Optimization Method?</i>	14 Oct 2022
<b>Optimization and Applications Seminar, Josip Juraj Strossmayer University of Osijek</b> , Osijek, Croatia <i>Interpolatory Conditions for <math>\mathcal{L}_2</math>-optimal Reduced-order Modeling</i>	14 Sep 2022
<b>Applied Numerical Analysis Seminar, Virginia Tech</b> , Blacksburg, VA, USA <i>Structured <math>\mathcal{L}_2</math>-optimal Parametric Model Order Reduction</i>	1 Apr 2022
<b>Applied Numerical Analysis Seminar, Virginia Tech</b> , Blacksburg, VA, USA <i>H<sub>2</sub> <math>\otimes</math> <math>\mathcal{L}_2</math>-optimal Parametric Model Order Reduction via Wilson-type conditions</i>	24 Sep 2021
<b>Optimization and Applications Seminar, Josip Juraj Strossmayer University of Osijek</b> , Osijek, Croatia <i>Model Order Reduction for Parametric Stationary Problems</i>	22 Dec 2021
<b>Optimization and Applications Seminar, Josip Juraj Strossmayer University of Osijek</b> , Osijek, Croatia <i>System-theoretic Model Order Reduction in pyMOR</i>	2 May 2019
<b>Numerical Mathematics and Scientific Computing Seminar, Faculty of Science, University of Zagreb</b> , Zagreb, Croatia <i>Optimalna H<sub>2</sub> redukcija s očuvanjem strukture za linearne sustave</i>	24 Apr 2019
<b>Imura Lab Seminar, Tokyo Institute of Technology</b> , Tokyo, Japan <i>H<sub>2</sub>-optimal Model Order Reduction of Network Systems</i>	21 Jul 2017
<b>Computational Methods in Systems and Control Seminar, Max Planck Institute for Dynamics of Complex Technical Systems</b> , Magdeburg, Germany <i>H<sub>2</sub>-optimal Model Order Reduction of Structured Linear Systems</i>	11 Jul 2017
<b>Seminar Regelungssysteme, Technische Universität Berlin</b> , Berlin, Germany <i>Efficient Structure-preserving Model Order Reduction for Multi-agent Systems</i>	22 Sep 2015

