Amritam Das

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Education

Eindhoven University of Technology **The Netherlands**
PhD in Electrical Engineering *Sep.'16 - Nov.'20*
Thesis title: A digital twin for controlling thermo-fluidic processes (demo here)

Eindhoven University of Technology **The Netherlands**
MSc in Systems and Control *Sep.'14 - Aug.'16*
Thesis title: Vehicle dynamics simulation & control

SRM University **India**
BTech in Mechatronics Engineering *May'10 - Apr.'14*
Thesis title: Fabrication of flapping winged ornithopter-Zapdos (demo here)

Areas of Interest

- Control of multi-physics processes
- Physics informed learning
- Nonlinear systems
- Computational neuroscience

Previous Research Experiences

Post-Doctoral Fellow- KTH Royal Institute of Technology
A learning and control theory for switches and clocks *Oct.'21 - Present*
Mentor: Prof. Karl H. Johansson **Application Area**: Neuroscience, Neural Networks

- Develop an input-output theory to analyze and design *Relay- Feedback* systems
- Develop an architecture for data-driven learning of oscillators

Post-Doctoral Research Associate- University of Cambridge
A multi-resolution theory for systems and control across scales *Oct.'20 - Sep.'21*
Mentor: Prof. Rodolphe Sepulchre **Application Area**: Nuromorphic Engineering

- Theory of input-output properties for nonlinear systems in mixed-feedback structure
- Learning and modulation of spiking behaviour from a biological neural network

Doctoral Research- Eindhoven University of Technology
A digital twin for controlling thermo-fluidic processes *Sep.'16 - Nov.'20*
Mentors: Prof. Siep Weiland, Dr. Matthew Peet **Application Area**: DOD Inkjet Printing

- A scalable modeling framework of spatially interconnected thermo-fluidic processes
- Virtual prototyping tool for closed loop control of thermal effects in inkjet printhead.

Visiting Research Experiences

University of California Santa Barbara
Contraction theory for analyzing neural-field models *Mar.'22 - present*
Mentor: Prof. Francesco Bullo **Application Area**: Computational Neuroscience

- Analysis of spatio-temporal neural-field models using Non- Eucleadian Contraction Theory

Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg
Fast model reduction of fluid dynamical models *Dec.'19*
Mentor: Dr. Jan Heiland **Application Area**: Fluid Dynamics

- Model reduction of finite element models using Auto-Encoders and Decoders.

Arizona State University
Real-time algorithms for controlling thermo-fluidic processes *Oct.'18 - Feb.'19*
Mentor: Dr. Matthew Peet **Application Area**: Nuclear Fusion

- Co-develop computational tool, **PIETOOLS**, for control of thermo-fluidic processes

Industrial Experiences

Masters Graduation Project - 2gethere B.V.
Optimal Trajectory Tracking Control of Automated Guided Vehicles *Nov'.15 - Aug.'16*
Mentor: Dr. Menno de Graaf **Application Area**: Autonomous Driving

- Develop an online control system for dynamic behaviour of multi-axle vehicles in PYTHON.

Traineeship - Canon Production Printing
Parametric Estimation & Prediction- An Application for DOD Inkjet Printer *Jul.'15 - Oct.'15*
Mentor: Dr. Amol Khalate **Application Area**: DoD Inkjet Printing

- Data driven joint estimation and prediction of varying parameters in an inkjet print-head.

Awards

- Recipient of Océ Merit Scholarship for '14-'16 (only 5 candidates selected)
- Recipient of ALSP Scholarship at the Eindhoven University of Technology for '14-'16
- Gold medalist at the SRM University for being the valedictorian of the batch '10-'14
- Chancellor's Scholarship at the SRM University for education during '10-'14

Writing Grant Applications

VENI Proposal
RoDNI- Robust Design of Neuromorphic Infrastructure *In preparation*
Funding body: NWO **Application Area**: Computational neuroscience

- Personal grant to develop a novel control theory for the design of excitable oscillators

EU Horizon Project (granted to KTH)
Multi-Level Trustworthiness to Improve the Adoption of Hybrid Artificial Intelligence *Granted*
Funding body: EU **Application Area**: Artificial Intelligence

- Assisting in preparing the work-packages, reporting the results, coordinating with partners

Teaching and Mentorship

Pedagogical Experience

Eindhoven University of Technology
Lead Teaching Assistant *'16 – '20*
5LMA0: Model Reduction
Lecturer: prof. Siep Weiland

Eindhoven University of Technology
Teaching Assistant and Lab Instructor *'16 – '17*
5ESB0: Systems
Lecturer: dr. Mircea Lazar

University of Cambridge
Teaching Supervisor *'20 – '21*
GF1: Control Systems Porject
Lecturer: Dr. Fulvio Forni

Supervision of Graduation Project

ir. Dat Hoang **Eindhoven University of Technology**
Sensorless Field-Oriented Estimation of Hybrid Stepper Motors *Mar.'17 – Sep'17*

ir. Pradheep Shakthivel **Eindhoven University of Technology**
Predicitve Control of Thermo-fluidic Processes in Inkjet Printing *Nov.'17 – Aug.'18*

ir. Martijn Princen **Eindhoven University of Technology**
Validating Thermo-Fluidic Processes in Inkjet Printer *Sep.'18 – Aug.'19*

ir. Ke Chen **Eindhoven University of Technology**
Infinite Dimensional Controller Design for Thermal Processes *Sep.'18 – Feb.'19*

Software skills

Softwares: Simulink, Simscape, COMSOL, LabVIEW, MS Office, Latex
Languages: C, C++, PYTHON, Julia, R, MATLAB

Outreach and Networking

- Co-organize Stockholm Workshop on Emerging Topics in Systems and Control-'22 (link)
- Co-organize IEEE CSS Workshop on Control for Societal-Scale Challenges-'22 (link)
- Co-author of IEEE CSS Roadmap-2030 (only two post-docs are involved)
- Host and founder of KTH Physics Informed Learning reading club (link)
- Invited Workshop on 'A showcase of LMI-based methods for PDEs' for IFAC-World Congress'23
- Author of a public outreach article in Mechatronica Machinebouw Magazine (link)
- Reviewer of flagship journals and conferences from IEEE and IFAC
- Hosting a podcast series about technology, society, and philosophy (coming soon)

Social Causes

- Effective Altruism, Open Source Initiative, Sustainability

Publications

PhD. Thesis

- A. Das (2020). A Digital Twin for Controlling Thermo-Fluidic Processes. Technische Universiteit Eindhoven. isbn: 978-90-386-5140-8

Inivited Book Chapter

- A. Das, and I. Mareels, "The Impact of Automatic Control Research on Industrial Innovation: Enabling a Sustainable Future" *Wiley-IEEE Press*, 2022. **Status: Accepted, In Press**

Peer-reviewed Journals-Accepted

- A. Das, T. Chaffey and R. Sepulchre, "Oscillations in mixed-feedback systems" *Systems and Control Letters*, 2022. **Status: Accepted, In Press** doi:10.1016/j.sysconle.2022.105289
- S. Shivakumar, A. Das, M. Peet, and S. Weiland, "Extension of the partial integral equation representation of GPDE input-output systems," *IEEE Transactions on Automatic Control*, 2022. **Status: Accepted** (preprint link here)
- A. Das and M. Peet, "Input to state stability of ODE-PDE coupled systems Using LPIs," *Automatica*, 2021. **Status: Provisionally Accepted with minor revision**
- A. Das, M. Princen, M. Shokrpour, A. Khalate and S. Weiland, "Soft sensing based in situ control of thermo-fluidic processes in DoD inkjet printing," *IEEE Transactions of Control Systems Technology*, 2020. doi: 10.1109/TCST.2021.3087576
- R. Van Kampen, A. Das, S. Weiland and M. Van Berkel, "A closed-form solution to estimate spatially varying parameters in heat and mass transport," *IEEE Control Systems Letters*, 2020. doi: 10.1109/LCSYS.2020.3042933

Peer-reviewed Journals-Under Review/Preparation

- M. Aguiar, A. Das and K. H. Johansson, "Neural network architecture for learning flows of controlled dynamical systems," *Journal of Neural Networks*, 2022.
- A. Das and S. Weiland, "Modeling and estimation of networked thermo-fluidic processes in application to paper drying systems," *IEEE Transactions of Control Systems Technology*, 2021.
- S. Shivakumar, A. Das, M. Peet and S. Weiland, "Duality and $\mathcal{H}_\infty$-optimal control of coupled ODE-PDE systems," *IEEE Transactions of Automatic Control*, 2021.

Peer-reviewed Conferences and Presentations

- S. Shivakumar, A. Das and M. Peet, "Computational stability analysis of PDEs with integral terms using the PIE framework" *IEEE Conference on Decision and Control*, Cancún, Mexico, December 2022. (submitted)
- A. Das, S. Shivakumar, M. Peet and S. Weiland, "Robust analysis of uncertain ODE-PDE systems using PI multipliers, PIEs and LPIs," *IEEE Conference on Decision and Control*, Jeju Island, South Korea, December 2020.
- F. Miranda-Villatoro, A. Das and R. Sepulchre, "Differential analysis of lateral inhibition," *IEEE Conference on Decision and Control*, Jeju Island, South Korea, December 2020.
- S. Shivakumar, A. Das and M. Peet, "PIETOOLS: A matlab toolbox for manipulation and optimization of partial integral operators," *IEEE American Control Conference*, Denver, CO, USA, 2020.

- A. Das, S. Shivakumar, S. Weiland and M. Peet, "$\mathcal{H}_\infty$ optimal estimation for linear coupled PDE systems," *IEEE Conference on Decision and Control*, Nice, France, 2020.
- S. Shivakumar, A. Das, S. Weiland and M. Peet, "Generalized input-output properties of linear PDE-ODE coupled systems," *IEEE Conference on Decision and Control*, Nice, France, 2020.
- D. Hoang, A. Das, S. Koekebakker and S. Weiland, "Sensorless field-oriented estimation of hybrid stepper motors in high-performance paper handling," *IEEE Conference on Control Technology and Applications*, Hong Kong, China, 2019.
- A. Das, S. Weiland and M. Van Berkel, "Frequency domain estimation of spatially varying parameters in heat and mass transport," *IEEE American Control Conference*, Philadelphia, PA, USA, 2019.
- M. Peet, S. Shivakumar, A. Das and S. Weiland, "Discussion Paper: A new mathematical framework for representation and analysis of coupled PDEs," *IFAC Workshop on Control of Systems Governed by Partial Differential Equations*, Oxaca, Mexico, 2019
- A. Das, L. Iapichino and S. Weiland, "Model approximation of thermo-fluidic diffusion processes in spatially interconnected structures," *European Control Conference*, Limassol, Cyprus, 2018
- A. Das, Y. Kasemsinsup and S. Weiland, "Optimal trajectory tracking control for automated guided vehicless" *IFAC World Congress*, Toulouse, France, 2017.

Technical Reports

- A. Das, S. Shivakumar, S. Weiland and M. Peet, "Representation and stability analysis of pde-ode coupled systems", *arXiv*, 2018. preprint arXiv:1812.07186

References

Available upon request