

Andrea Brugnoli

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Academic Positions

University of Twente

Post-Doctoral researcher

Numerical methods for coupled port-Hamiltonian fluid-structure dynamics
ERC Advanced grant. Principal investigator: Stefano Stramigioli

Enschede

November 2020-November 2022

Education

ISAE-Supaero

PhD in Automatic Control

A port-Hamiltonian formulation of flexible structures: modelling and symplectic finite element discretization.
Supervisors: Daniel Alazard, Valérie Pommier-Budinger and Denis Matignon.

Toulouse

2017-2020

Université Paris Saclay/ Supélec

Research Master in automatics and image processing

Courses: inverse problem, advanced dynamics of flexible structures, parameter estimation.

Paris/Toulouse

2016-2017

ISAE-Supaero

Double degree in aerospace and aeronautical engineering

Specialisation in applied mathematics and advanced automatics: multidisciplinary optimisation, high performance computing, control of flexible structures.

Toulouse

2015-2017

Politecnico di Milano

Master in space engineering, 110/110 cum laude

Courses: orbital mechanics, structural dynamics and control, thermochemical propulsion.

Milan

2014-2017

Politecnico di Milano

Mechanical Engineering Degree, 110/110 cum laude

Courses: finite element method, mechanical vibrations, numerical methods for engineering.

Milan

2011-2014

Experiences

Institut CIFAR

Summer school in Artificial Intelligence and Reinforcement Learning

Toronto, Canada

July 2021

ITA-Instituto Tecnológico de Aeronáutica

Visiting researcher

Collaboration with Flavio Cardoso-Riberio on numerical methods for port-Hamiltonian systems.

São José dos Campos

January 2019, 4 months

CNES-Centre national des études spatiales

Internship

Analysis of dismissed satellites subjected to solar pressure to identify stable and periodic pointing configurations.

Toulouse

2017, 6 months

Politecnico di Milano in partnership with Danieli S.p.A

Bachelor project

Dynamics of a forging manipulator. Project selected for the final presentation at Danieli.

Milan

2014, 3 months

Languages

English: fluent

French: fluent

Spanish: intermediate

Portuguese: intermediate

Italian: native speaker

Computer skills

Softwares and platforms: Simulink, Abaqus, Inventor, Solid Works, Labview

Languages: Python (especially FEM librairies: FEniCS and Firedrake), Matlab, Java, C, \LaTeX

OS: Linux environment (Fedora, Ubuntu)

Awards

Fondation ISAE-SUPAERO

PHD Thesis Award

2021

Politecnico di Milano

Partial tuition fee waiver for academic merit.

2011-2016

References

Denis Matignon

Department of Applied Mathematics

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Paul Kotyzca

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Daniel Alazard

Department of Space and Aeronautics Vehicle

Dynamics

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Stefano Stramigioli

Robotics & Mechatronics

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Publications

International journal articles

- [1] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Port-Hamiltonian formulation and symplectic discretization of plate models. Part I: Mindlin model for thick plates. *Applied Mathematical Modelling*, 75:940 – 960, Nov 2019. <https://doi.org/10.1016/j.apm.2019.04.035>.
- [2] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Port-Hamiltonian formulation and symplectic discretization of plate models. Part II: Kirchhoff model for thin plates. *Applied Mathematical Modelling*, 75:961 – 981, Nov 2019. <https://doi.org/10.1016/j.apm.2019.04.036>.
- [3] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Port-Hamiltonian flexible multi-body dynamics. *Multibody System Dynamics*, 51(3):343–375, Mar 2021. <https://doi.org/10.1007/s11044-020-09758-6>.

- [4] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. A port-Hamiltonian formulation of linear thermoelasticity and its mixed finite element discretization. *Journal of Thermal Stresses*, 44(6):643–661, May 2021. <https://doi.org/10.1080/01495739.2021.1917322>.
- [5] A. Brugnoli, G. Haine, A. Serhani, and X. Vasseur. Numerical approximation of port-Hamiltonian systems for hyperbolic or parabolic PDEs with boundary control. *Journal of Applied Mathematics and Physics*, 9:1278–1321, 2021. <https://doi.org/10.4236/jamp.2021.96088>.
- [6] F. Califano, R. Rashad, A. Dijkshoorn, L. Groot Koerkamp, R. Snee, A. Brugnoli, and S. Stramigioli. Decoding and realising flapping flight with port-Hamiltonian system theory. *Annual Reviews in Control*, 51:37–46, 2021. <https://doi.org/10.1016/j.arcontrol.2021.03.009>.
- [7] A. Brugnoli, R. Rashad, and S. Stramigioli. Dual field structure-preserving discretization of port-Hamiltonian systems using finite element exterior calculus. *arXiv preprint arXiv:2202.04390*, 2022. Under Review.

International conferences with proceedings.....

- [8] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Partitioned finite element method for the Mindlin plate as a port-Hamiltonian system. In *3rd IFAC Workshop on Control of Systems Governed by Partial Differential Equations CPDE 2019*, pages 88 – 95, Oaxaca, MX, 2019.
- [9] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Interconnection of the Kirchhoff plate within the port-Hamiltonian framework. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pages 6857–6862, 2019.
- [10] F. L. Cardoso-Ribeiro, A. Brugnoli, D. Matignon, and L. Lefèvre. Port-Hamiltonian modeling, discretization and feedback control of a circular water tank. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pages 6881–6886, 2019.
- [11] A. Brugnoli, F. L. Cardoso-Ribeiro, G. Haine, and P. Kotyczka. Partitioned finite element method for structured discretization with mixed boundary conditions. *IFAC-PapersOnLine*, 53(2):7557–7562, 2020. 21st IFAC World Congress.
- [12] A. Brugnoli, D. Alazard, V. Pommier-Budinger, and D. Matignon. Structure-preserving discretization of port-Hamiltonian plate models. *IFAC-PapersOnLine*, 54(9):359–364, 2021. 24th International Symposium on Mathematical Theory of Networks and Systems MTNS 2020.
- [13] A. Brugnoli, R. Rashad, F. Califano, S. Stramigioli, and D. Matignon. Mixed finite elements for port-Hamiltonian models of von Kármán beams. *IFAC-PapersOnLine*, 54(19):186–191, 2021. 7th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control LHMNC 2021.
- [14] K. Cherifi and A. Brugnoli. Application of data-driven realizations to port-Hamiltonian flexible structures. *IFAC-PapersOnLine*, 54(19):180–185, 2021. 7th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control LHMNC 2021.
- [15] R. Rashad, F. Califano, A. Brugnoli, F. P. Schuller, and S. Stramigioli. Exterior and vector calculus views of incompressible Navier-Stokes port-Hamiltonian models. *IFAC-PapersOnLine*, 54(19):173–179, 2021. 7th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control LHMNC 2021.

International conferences without proceedings.....

- [16] A. Brugnoli, D. Matignon, G. Haine, and A. Serhani. Numerics for physics-based PDEs with boundary control: the partitioned finite element method for port-Hamiltonian systems. In *SIAM Conference on Computational Science and Engineering (CSE21)*, Virtual conference, 2021.