Mauro Murer

Profile

I'm a civil engineer with a strong passion for computational mechanics applied to several physical problems. A Ph.D. candidate at University of Pavia, I'm presently working on numerical methods for solid and fluid mechanics applied to Additive Manufacturing processes. My skills are in FEM analysis, Computational Fluid Dynamics and algorithms development for scientific computing with open-source libraries and software. I had experience of collaboration with researchers and students during courses and thesis drafting.

Relevant Informatics Skills

Programming languages: C++, MathWorks MATLAB, Python, Wolfram Mathematica.
Open-source software: Deal.II, FEniCS, OpenFOAM, MPI, Paraview, Git.
Linear algebra libraries: Eigen, PETSc, Trilinos, SLEPc.
Commercial software: COMSOL Multiphysics, Star CCM+, SAP2000.
OS: Windows, Mac OS, Linux.

Languages

Italian: Native speaker
English: Upper intermediate (B2)

Qualification

2017 – 2020   PhD Student in Computational mechanics   *University of Pavia*

PhD in Design, Modeling and Simulation in Engineering, 33rd cycle.
Thesis: "CFD simulations of Laser Metal Deposition process exploring open-source software".
Supervisor: Prof. Ferdinando Auricchio.

2014 – 2017   M.Sc. in Structural Engineering [110/110 cum laude]   *Roma Tre University*

Thesis: "Modeling and simulation of nonlinear dynamics of suspension bridge using VPL (Visual Programming Language)".
Supervisor: Prof. Giovanni Formica.

2010 – 2014   B.Sc. in Civil Engineering [100/110]   *Roma Tre University*

Thesis: "River Arrone embankment adjustment project with HEC-RAS".
Supervisor: Prof. Guido Calenda.

Academic Experience

Computational Fluid Dynamics (CFD)

Developer of a FEM code for the simulation of particles flow in additive manufacturing processes using a C++ finite element library (Deal.II). The coupling of the Navier-Stokes system of equations with the heat advection-diffusion equation, together with a Lagrangian particle tracking method able to interact with Eulerian fields, are the main topics. Previous investigations were performed with OpenFOAM and Star CCM+ software. The study is supervised by Prof. Giovanni Formica, Dr. Franco Milicchio and Prof. Ferdinando Auricchio for the PhD thesis in Design, Modeling and Simulation in Engineering at University of Pavia.

Virtual Element Method (VEM)

Developer of a C++ code for the analysis of the "Virtual Element Method" used to spatially discretize partial differential equations. A comparison with the Finite Element Method is performed implementing the Poisson equations. The study was supervised by Prof. Ferdinando Auricchio and Dott. Giulia Scalet during my PhD in Design, Modeling and Simulation in Engineering at University of Pavia.

Non-linear Mechanics

Developer of a Python code, fully integrated in the 3D CAD tool Autodesk's Maya, in order to model and analyze the nonlinear response of suspended bridges subject to aerodynamical loading conditions. PRIN research project in collaboration with Prof. Giovanni Formica and Dr. Franco Milicchio.

Structural Design

- Development of a MATLAB user-friendly code for the design of prestressed reinforced concrete beams for bridge decks (Theory and Design of Bridges, M.Sc. in Structural Engineering).
- Structural modeling and analysis employing the SAP2000 software (Theory and Design of Bridges and Design is Seismic Zone, M.Sc. in Structural Engineering).
- Development of a Wolfram Mathematica code for the application of linear dynamic analysis to design structures in seismic zones (Design is Seismic Zone, M.Sc. in Structural Engineering).
- Study of elastic and viscoelastic beam models by means COMSOL Multiphysics software (Theory of Structures course, M.Sc. in Structural Engineering).
- Development of a Wolfram Mathematica code for the study of forced oscillations of a non-inertially homogeneous wedged beam (Computational Mechanics, M.Sc. in Structural Engineering).
- Study of the vibration modes of a multi-storey frame through the use of COMSOL Multiphysics software (Dynamic of Structures, M.Sc. in Structural Engineering).
- Development of a MATLAB code for the study of wave propagation (Coastal Engineering, M.Sc. in Structural Engineering).

Work experience

2016 – 2017   Project Engineer   I.R.I.D.E. Srl

<u>Main activities:</u> (i) setting up numerical simulations to model acoustic waves propagation due to aeronautic and road traffic, (ii) writing final reports for environmental impact studies, and (iii) implementation of MATLAB script algorithms in order to optimize the data import process within calculation software.

Publications

1) M.Murer, G.Formica, F.Milicchio, S.Morganti, F.Auricchio,
   "An efficient and accurate numerical method for advection-diffusion coupled problems",
   Journal of Computational Physics, submitted for publication.

2) M.Murer, G.Formica, S.Morganti, F.Auricchio,
   "Numerical simulation of particles flow in Laser Metal Deposition technology comparing Eulerian-Eulerian and Lagrangian-Eulerian approaches",
   Journal of Manufacturing Processes, submitted for publication.

3) G.Formica, F.Milicchio, M.Murer, P.2019,
   "An Integrated CAD Strategy for Nonlinear Dynamics of 3D Suspended Bridges",
   Computer-Aided Design and Applications, 16(6):1046-1062.

Proceedings in International Conferences

1) S.Morganti, G.Alaimo, A.Cattenone, M.Murer, G.Formica, F.Auricchio, 2021,
   "Computational simulations for industrial applications in additive manufacturing",
   ECCOMAS-WCCM XIV - World Congress on Computational Mechanics (11-15 January 2021, Paris, France).

2) M.Murer, G.Formica, S.Morganti, F.Auricchio, 2019,
   "Numerical simulation of particles flow in Laser Metal Deposition technology",
   II International Conference on Simulation for Additive Manufacturing 2019 (11-13 September 2019, Pavia, Italy).

3) G.Formica, F.Milicchio, M.Murer, 2018,
   "An Integrated CAD Strategy for Nonlinear Dynamics of 3D Suspended Bridges",
   ESMC 2018 - European Solid Mechanics Conference (2-6 July 2018, Bologna, Italy).

Teaching Activities

- 2019-21: Teaching assistant for the course of *"Solid Mechanics"* taught by Prof. Fabio Carli for bachelor's degrees in Civil Engineering, Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2017-21: Teaching assistant for the course of *"Calcolo automatico delle strutture (Computer-Aided Structural Mechanics)"* taught by Prof. Giovanni Formica for master's degrees in Architecture, Department of Architecture, Roma Tre University.

Extras

- 2017-21: Nume-lab member of the HPC Compmech Group, Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2017: Licensed Professional Civil Engineer (State examination)

Relevant Courses

- 2019: *"Computational Methods for Nonlinear Mechanics"* taught by Prof. F. Auricchio and Prof. A. Reali at the Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2019: "State of the art computational methods for nonlinear solid mechanics" taught by Prof. F. Auricchio, Prof. J. Gil, Prof. C. H. Lee, Prof. J. Bonet and Prof. R. Ortigosa at Palazzo Vistarino, University of Pavia.

- 2019: *"Introductory Course in OpenFOAM CFD Toolbox"* taught by Dr. A. Georgoulas at the Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2019: *"Isogeometric Analysis"* taught by Prof. A. Reali, Dr. G. Lorenzo and Dott. A. Patton at the Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2018: *"Advanced Materials Methods"* taught by Prof. F. Auricchio at the Department of Civil Engineering and Architecture (DICAr), University of Pavia.

- 2018: *"ECCOMAS Advanced Course NL18: Nonlinear Computational Solid and Structural Mechanics"* taught by Prof. F. Brezzi, Prof. R. L. Taylor, Prof. A. Reali and Prof. F. Auricchio at Palazzo Vistarino, University of Pavia.

- 2018: *"Computational Mechanics for Scientific Problems"* taught by Prof. G. Sangalli, Dr. G. Lorenzo, Dr. J. E. Dufour and Prof. A. Reali at the Department of Mathematics, University of Pavia.

Roma, 14/12/2020