Nicola Demo

Website: nicolademo.xyz
Email: nicola.demo@sissa.it
Linkedin: nicola-demo
Github: github.com/ndem0

EDUCATION AND EXPERIENCE

Tecnologo   *SISSA, Trieste*
I am employed as Technologist within the SISSA mathLab group, in the Mathematical Analysis, Modelling and Applications area.   2023 - current

Chief Technology Officer   *FAST Computing Srl, Trieste*
I am co-founder and chief technology officer of the FAST Computing company   2022 - current

Research Fellow   *SISSA, Trieste*
I was employed as researcher fellow ("Assegnista di ricerca") within the SISSA mathLab group, in the Mathematical Analysis, Modelling and Applications area. My main research topics are: model order reduction, data-driven modeling, scientific computing, parallel programming, shape parameterization, shape optimization, machine learning, deep learning   2017 - 2023

Internship   *Fincantieri, Trieste*
During the MHPC thesis, I worked as HPC specialist to build an efficient pipeline for the naval bulb shape optimization, coupling an automated freeform deformation, a finite volume solver and the model reduction   2016

Master in HPC   *SISSA, Trieste*
thesis: 'Increasing speedup of naval hull workflow optimization using Reduced Order Method' with the supervision of Prof. L. Heltai   2015 - 2016

B. Sc. in Computer Science   *University of Ferrara*
thesis: 'Parallelizzazione e vettorizzazione di un algoritmo Lattice Boltzmann mediante direttive di compilazione' with the supervision of Prof. F. S. Schifano   2012 - 2015

Scientific diploma   *Liceo Ariosto, Ferrara*
                                                                  2007 - 2012

PROJECTS

MARINAI
AI-assisted methodology to reduce underwater radiated noise from ship and motor-yacht propellers. It leverages high-fidelity CFD and hydroacoustic simulations to train machine-learning models, delivering a design tool for quieter, more efficient propulsion with lower fuel use and shorter design cycles.

BJMI

Project to accelerate Binder Jetting adoption in Italy by combining an AI algorithm that scouts suitable geometries with recycled-scrap metal powders. Targets flexible, sustainable production of complex parts for industry and luxury sectors, improving efficiency and lowering environmental impact.

ARGOS

ERC Proof of Concept delivering a browser-based web server hosting reduced-order modelling offline-online apps with real-time responses. No local installs; demos span bioengineering, structural mechanics and fluid-dynamic shape optimisation, building on open-source AROMA-CFD libraries (ITHACA, RBniCS).

AROMA

I developed methodologies for CFD using an approach data-based, implementing them inside an open source environment. I developed the web graphical interface ARGOS as frontend of the AROMA-CFD methodologies, so making them available directly on web-browser

UBE2

In this project, I dealt with the implementation of a web interface capable to perform, and visualize, real-time algorithms for the higher order spectral analysis

PhD4PMI

In this Proof of Concept, I collaborate with Wärtsilä in merit of application of machine learning and deep learning algorithm to estimate the fuel consumption for hybrid naval engine

MISTI

I collaborate with the Massachusetts Institute of Technology for an advanced optimization pipeline that includes reduced order modeling, shape parameterization, multi-fidelity models, gaussian process regression

SOPHYA

I have been involved in the POR-FESR SOPHYA project, which had the goal of increase the performances of planing hulls. In particular, I worked on the data-driven reduced order model and on the shape parameterization for an efficient shape optimization procedure

SAFE

I contributed within the POR-FESR SAFE project for the development of a digital twin of the ship, based on graph theory, for the dynamic quantification of damages occurred on-board.

HeAD

Within this project, I had the opportunity to collaborate with Fincantieri SpA for the development of an (open source) framework capable to exploit the reduced order modeling benefits for an industrial shape optimization problem

Software

PyDMD https://mathlab.sissa.it/pydmd
Python Dynamic Mode Decomposition

EZyRB https://mathlab.sissa.it/ezyrb
Easy Reduced Basis Method

PyGeM https://mathlab.sissa.it/pygem
Python Geometrical Morphing

ARGOS https://argos.sissa.it
Advanced Reduced order modellinG: Online computational web server for parametric Systems

PINA https://mathlab.github.io/PINA/
Physics-Informed Neural networks for Advanced modeling

Conference

SIAM MDS 2024 *Atlanta*, October 2024
Presentation and Tutorial Session
Physics Informed Neural Networks for Advanced Modeling: PINA Library and Tutorials

Eccomas Congress 2024 *Lisbona*, June 2024
9th European Congress on Computational Methods in Applied Sciences and Engineering
PINA: a PyTorch Framework for Deep Differential Equation Learning for Research and Production Environments

ICLR 2024 *Vienna*, May 2024
Poster Presentation at AI4DifferentialEquations workshop
PINA: a PyTorch Framework for Solving Differential Equations by Deep Learning for Research and Production Environments

Advanced School on Applied Machine Learning *Trieste*, May 2024
Summer School on Applied ML at ICTP
Accelerating Numerical Simulations by means of Physics Informed Machine Learning

M2P2023 *Teormina, Messina*, June 2023
Ecccomas Conference on Emerging Technologies in Computational Science for Industry, Sustainability and Innovation
ARGOS: The Computational Web Platform for Fast Simulation

CSE23 *Amsterdam*, Febraury 2023
SIAM Conference on Computational Science and Engineering
Real-Time Modeling Through Neural Networks: Challenges and Perspectives

ESB2022   *Oporto*, June 2022

27th Congress of the European Society of Biomechanics

A Web platform for data-driven, real-time modeling and visualizing cardiovascular problems

SIMAI 2020+2021   *Parma*, September 2021

Convegno nazionale della Società Italiana di Matematica Applicata e Industriale

A Computational Pipeline Exploiting Reduced Order Modeling Techniques For Industrial Shape Optimization Problems

MARINE 2021   *Virtual (Edinburgh)*, June 2021

IX International Conference on Computational Methods in Marine Engineering

Data-driven reduced order modeling for efficient solution of industrial shape optimization problems

CSE21   *Virtual (Fort Worth)*, January 2021

SIAM Conference on Computational Science and Engineering

Accelerating Shape Optimization Problems by Means of Model Order Reduction

WCCM ECCOMAS   *Virtual (Paris)*, January 2021

A Modular And Data-driven Framework Involving Reducing Order Methods For Naval Optimization Industrial Problems

DAEDALUS Winter School   *Berlin*, December 2019

Machine Learning meets Numerical Analysis of PDE

ROM Summer School   *Trieste*, July 2019

Reduced Order Methods in Computational Fluid Dynamics

MARINE   *Goteborg*, May 2019

VII International Conference on Computational Methods in Marine Engineering

MOR Summer School   *Hamburg*, September 2018

Model Order Reduction Summer School

NAV   *Trieste*, 2018

19th International Conference on Ship & Maritime Research

PUBLICATIONS

The complete list of all publications is attached on a separate files.