

 Boston, MA/Austin, TX  e_medina@g.harvard.edu  medinaeder.github.io  medinaeder

I combine **applied mathematics** and **mechanical engineering** to design novel structures. I specialize in scientific computing applied to nonlinear mechanics problems. I solve **large-scale optimization problems**, discover **multiple solutions** in nonlinear PDEs, adapt the best **open-source scientific computing software** into existing workflows, and conduct **physical experiments** on model systems.

Education

Aug 2016 – present **PhD Candidate in Engineering Science, SM (2020)**
@ Harvard University

I work on the computational design of the next generation of mechanical meta-materials. Specifically, I apply my expertise in **computational mechanics** and **numerical analysis** to solve large scale PDE-constrained optimization and analyze of nonlinear mechanical systems to design multi-functional structures.

Aug 2012 – May 2016 **BSc Mechanical Engineering @ University of Texas-Austin**
Computational Science Certificate, Mathematics Minor

During my undergraduate research project, I visualized and explored local changes in myocardium over time with Matlab and Mathematica. Specifically, I analyzed sono-micrometry crystal embedded in bovine myocardium to better understand the effects and progression of heart attacks on left ventricle structure.

Programming Skills

Python

I have thorough knowledge of the Python ecosystem including **scientific computing**(Numpy, Numba, Scipy), **data analysis and visualization** (pandas, matplotlib, paraview/vtk, openCV), **large scale simulations**(petsc4py, mpi4py)

Machine Learning

I am comfortable with modern machine learning tool kits **Jax, Pytorch, Tensorflow, scikit-learn**. I am also familiar with probabilistic machine learning.

Additional Software Development skills

I am comfortable with programming in **C/C++, Linux, git**, and modern software development workflows. I have contributed to **open-source software** projects (dolfin-adjoint/fireshape)

Other Skills & Interests

- » Strong **communication skills**
- » Data Visualization
- » Rapid prototyping and **additive manufacturing**
- » Experience with CAD
- » Strong **applied mathematics background**
- » Experimental physics
- » **Languages:** English (native), Spanish (native)

Additional Education

- » **Summer School @ Simula Summer 2021** — *Simula Summer School in Computational Physiology*. Studied the effects of fiber dispersion in different heart tissue constitutive models.
- » **Winter School @ NECSI Winter 2020** — *New England Complex Systems Institute Winter School*. Developed an agent based model to simulate locust swarms
- » **REU @ Stanford Summer 2014** — *Leadership Alliance Summer Early Identification Program @ Farhat Research Group*. Assessed uses of Automatic Differentiation in FEM
- » **Summer Course @ ODTU Summer 2013** — *Energy Conversion Systems Program in Ankara, Turkey*. Evaluated the effectiveness of concentrated solar powered systems in different regions
- » **Spring Course @ Delft TU Summer 2013** — *Concepts of Nuclear and Radiation Technology Program*. Studied different nuclear reactor designs.