Manuel Pena

Education

2015–2021 **Ph.D. in Aerospace Engineering**, *Universidad Politécnica de Madrid*, Spain, Cum Laude.
Thesis: *Application of a topological derivative based inversion method to infrared thermography damage detection and electromagnetic imaging*

2015–2017 **Ms. in Industrial Mathematics**, *Universidad Politécnica de Madrid*, Spain, Specialized in Mathematical Modelling.
Thesis: *Detección de daño en estructuras mediante el análisis de termografías.*

2009–2015 **Degree and Ms. in Aeronautical Engineering**, *Universidad Politécnica de Madrid*, Spain, Specialized in Space Vehicles.
Thesis: *High polynomial degree DG-FEM for multigroup radiative transfer equations on triangular unstructured meshes.*

Ph.D. Thesis:

Title: *Application of a topological derivative based inversion method to infrared thermography damage detection and electromagnetic imaging*

Supervisor: Professor María-Luisa Rapún

Description: In this thesis a method for the solution of inverse problems based on the computation of the topological derivative of a misfit functional was studied. This method was already tested with synthetic electromagnetid data with very good results. The method was tested against experimental data from the Fresnel database with very good results. The method was also tested on infrared thermograms numerically generated with very promising results.

Experience

2018-Present **Teaching assistant**, *Universidad Politécnica de Madrid*, Madrid.
Teached the subject of "Informática" at the School of Areospace engineering. In this subject numerical analysis is teached while numerical methods are implemented in fortran (see `https://mpenar.github.io/NumericalMethods/docs/index.html`).

2017-2018 **Research assistant**, *Universidad Complutense de Madrid*, Madrid.
Used the SAMoS for cellular dynamic simulations.

2015 **Short term stay**, *ONERA, The French Aerospace Lab*, Paris.
ERASMUS grant in order to complete the Masters thesis under the supervision of Prof. Eric Savin. A MATLAB DG-FEM code for the radiative transfer multigroup equations was developed.

Publications

Articles

2021 (accepted) Carpio, Ana, Pena, Manuel, and María-Luisa Rapún. "Processing the 2D and 3D Fresnel experimental databases via topological derivative methods." Inverse Problems.

2020   Pena, Manuel, and María-Luisa Rapún. "Application of the topological derivative to post-processing infrared time-harmonic thermograms for defect detection." Journal of Mathematics in Industry 10.1: 1-25.

2019   Pena, M., and M-L. Rapún. "Detecting damage in thin plates by processing infrared thermographic data with topological derivatives." Advances in Mathematical Physics 2019.

2019   Pena, Manuel, and María-Luisa Rapún. "Damage detection in thin plates via time-harmonic infrared thermography." Progress in Industrial Mathematics at ECMI 2018: 639.

2018   Pena, Manuel, and María-Luisa Rapún. "Damage detection in two-dimensional plates via infrared thermography." Proceedings of ECCM6/ECFD7.

Oral presentations

2018   Pena, Manuel, and María-Luisa Rapún. "Damage detection in thin plates via time-harmonic infrared thermography." The 20th European Conference on Mathematics for Industry. Budapest

Posters

2021   Carpio Ana, Pena, Manuel, and María-Luisa Rapún. "Topological derivative inversion method tested against microwave experimental data". XIX Escuela Hispano-Francesa Jacques-Louis Lions sobre Simulación Numérica en Física e Ingeniería. Madrid

2018   Pena, Manuel, and María-Luisa Rapún. "Topological derivative applied to damage detection via infrared thermography. Time-harmonic excitation". Frontiers in Applied and Computational Mathematics 2018. New Jersey (NJ)

Seminars

2021   GAMM Juniors' Summer School 2021 on Shape and Topology Optimization. University of Graz. Austria.

2019   Finnish Inverse Problems Summer School 2019 (Summer School on Very Finnish Inverse Problems). University of Helsinki. Finland.

Postgraduate Grants

2018   **Short term stay**, *University of Delaware, Department of Mathematical Sciences.*, Delaware (DE).
Six-month doctoral stay under the supervision of Prof. Francisco-Javier Sayas where we developed a convolutional neural network in MATLAB from scratch.

Languages

Spanish   **Mothertongue**

English   **Advanced**   *TOEFL: 99/120*

Computer Skills

- Languages: Python (numpy, scipy, matplotlib, tensorflow...), Fortran and Matlab/Octave.
- Simulation-cycle software: gmsh, FreeFEM and paraview.
- Editting: LaTeX, LyX and BibTeX.