Dimitrios Pallas

Email GitHub Personal Website

Education

National Technical University of Athens (NTUA) *Sept 2019 – Oct 2024*
Diploma (Integrated MSc) in Mechanical Engineering

- GPA: 8.49/10
- Energy engineering concentration
- Relevant coursework: Computational Methods, Optimization, Aerodynamics and Aeroelasticity, Multiphase Flows and Transport Phenomena
- Diploma thesis:
  - Title: "Multidisciplinary Analysis and Optimization: Theory, Implementation and Application"
  - Advisor: Kyriakos C. Giannakoglou
  - Brief description: The thesis is concerned with the development, implementation and validation of MDAO methods, and their application to problems, mainly in the areas of FSI (Fluid-Structure Interaction) and aerostructural optimization. Among the problems solved is the aerostructural optimization of an aircraft wing. Flow simulations are performed using an in-house GPU-enabled CFD code, while a new C++ finite-element code is developed for the structural model. The disciplinary codes are coupled through mSense, a Python package for MDAO, developed within this thesis. The coupled model is optimized, with the goal of reducing the drag and weight of the wing.
  - Link
- Other notable work:
  - Multidisciplinary Design Optimization of a Supersonic Business Jet, modeled with analytical equations
  - Development and experimental validation of a finite-difference solver for the simulation of heat transfer in arc welding
  - Airfoil shape optimization using XFOIL and Particle Swarm Optimization

Personal Projects

SFEM *dlmpal.github.io/sfem*

- Finite-element/volume C++ framework for the numerical solution of PDEs on unstructured meshes
- Distributed-memory parallelism via the MPI protocol
- Python interface for integration with other software
- METIS for mesh partioning, PETSc and SLEPc for linear algebra

mSense *dlmpal.github.io/msense*

- A Python framework for Multidisciplinary Analysis and Optimization (MDAO)
- Effortless integration and coupling of disciplinary solvers, from Python modules to external executables
- Efficient Multidisciplinary Sensitivity Analysis (MDSA) via the Coupled Adjoint method
- Three Multidisciplinary Design Optimization (MDO) architectures available: MDF, IDF and CO
- Bindings for third-party optimizers such as SLSQP and IPOPT

Technical Skills

Programming Languages and tools: C++, C, CMake, Python, Fortran, Git, Linux

Parallelization: MPI, Threading, SIMD

Software: Gmsh, SolidWorks, OpenFOAM, ParaView, Visual Studio (Code)

Research Interests

Numerical solution of Partial Differential Equations (PDEs): Mathematical development and software implementation of finite-difference, finite-volume and finite-element solvers, especially for multi-physics. Development of adjoint methods (discrete, continuous) for PDE-constrained optimization. Higher-order methods.
Multidisciplinary Analysis and Optimization (MDAO): High-fidelity aerostructural and aerothermal-structural optimization, surrogate modeling for MDAO.

High-Performance-Computing (HPC): Parallelization of algorithms or existing software related to scientific computing, such as sparse iterative solvers. Use of accelerators (GPUs, TPUs).