

Athanasios MARTSOPOULOS

Mechanical/Robotics Engineer

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I am a Mechanical Engineer with a great passion for modelling, simulation and control of dynamical systems. My love for the simulation and animation of deformable bodies led me to pursue a PhD in robotics and autonomous systems, where I research the behaviour of soft materials for surgical applications. I have professional experience in both software and hardware development for aerospace and robotics applications. Skilled in C++, Python, and C. My interests and experience cover a wide range of tools and technologies, including mathematical modelling of dynamical systems, control systems design, state estimation and sensor fusion, system identification, trajectory optimization and path planning for robotic systems, linear/nonlinear optimization and machine learning, high-performance computing, computer graphics and computer vision. I hold an MEng in Mechanical Engineering (First-Class Honours) and I am currently pursuing my PhD in Robotics at the University of Bristol.

EDUCATION

- 2019- **PhD Candidate Robotics and Autonomous Systems**, University of Bristol, Bristol Robotics Lab.
Development of mathematical and computational tools for the real-time simulation of prostate biopsy/brachytherapy surgery.
- 2013-2018 **Diploma in Mechanical Engineering (MEng)**, Aristotle University of Thessaloniki.
First-Class Honours, Valedictorian : 8.97/10
- Specialization Field : Design and Structures
 - Level of Qualification : Integrated 1st and 2nd Cycle
 - Official Length of Programme : 10 Semesters, 300 ECTS

EXPERIENCE

- Present**
Oct 2022 **Software Engineer, SLINK-TECH,**
Develop and test code for UAV-related technology. The position includes various tasks such as the development of algorithms for the simulation of aerial vehicles with the help of UE4, networking and development of hardware and software in the loop solutions.
- C++ Python Unreal Engine Electronics Docker Networking Agile Methodologies
- Present**
Sep 2019 **PhD Candidate Robotics and Autonomous Systems, UNIVERSITY OF BRISTOL,**
My PhD focuses on creating high-fidelity mathematical models that aim to enhance our understanding of the physics of minimally invasive surgery and facilitate the development of robot-assisted surgery solutions. For this, my PhD focuses on :
- The development of mathematical and computational tools, based on the theory of continuum mechanics and flexible multibody dynamics, to allow the modelling of both soft human tissue and flexible surgical instruments.
 - Experimental studies that aim to reveal the mechanical and material properties of the soft human tissue and the underlying interaction dynamics of tissues with surgical instruments.
 - Development of real-time physics-based simulations/animations, path-planning and control algorithms for robotic manipulators (ROS). This also includes optimization and state estimation algorithms as well as sensor fusion.
 - Develop and implement highly efficient numerical algorithms for the solution of PDEs and ODEs for real-time applications.
- The wide breadth of my PhD thesis has allowed me to :
- Develop advanced mathematical models that combine and integrate tools from continuum mechanics, contact mechanics and flexible multibody dynamics.
 - Develop an advanced physics-based surgical simulator, with the help of C++ and OpenGL, that focuses on aspects of both accuracy and computational efficiency.
 - Implement computer vision algorithms with Python, C++ and OpenCV for the real-time motion tracking of deformable bodies (Digital Image Correlation, Photogrammetry).
 - Explore concepts of algorithmic efficiency and parallel computing with the help of the CUDA, OpenACC and OpenMP frameworks.
- C++ Python OpenGL OpenCV CUDA Mathematical Modelling Physics-Based Animation ROS
Nonlinear Optimization Control Theory Sensor Fusion CAD

Mar 2022	Research Associate in Robotics, UNIVERSITY OF BRISTOL,
Nov 2021	<p>In this position, I was responsible for the development of technologies that aimed to facilitate communication between the deaf and the hearing communities. This position included various activities including development of rendering environments, programming of embedded systems, networking and machine learning algorithms. More specifically My tasks included :</p> <ul style="list-style-type: none"> › Development and integration of a finger exoskeleton technology for tracking the British sign language. › Exploration of the capabilities of motion tracking, using machine learning and depth cameras, to facilitate the interpretation of sign language. › Research on VR and AR technologies and their capabilities for interpretation of sign language. <p>Computer Vision Machine Learning Embedded systems Motion Tracking Depth Cameras</p>
Sep 2019	Research Associate in Flight Mechanics, CIRI-ARISTOTLE UNIVERSITY OF THESSALONIKI,
Dec 2018	<p>In this position, I performed exhaustive research into the design of an unconventional Unmanned Aerial Vehicle (UAV), that combined VTOL and fixed-wing flying capabilities. As the principal flight mechanics and control engineer of the team, which is part of the Laboratory of Fluid Mechanics & Turbomachinery (LFMT) at Aristotle University of Thessaloniki, I was responsible for :</p> <ul style="list-style-type: none"> › Cooperating with the aeronautical engineers' team and developing a prototype UAV. › Developing a complete mathematical model of the proposed design. › Design and implement algorithms for navigation and motion control. › Implementation and testing of path planning and control algorithms. › Design of a simulation environment, including solvers for ODEs and graphical simulations (QtGraphics). › Embedded systems programming and hardware-in-the-loop simulations (ArduPilot/Pixhawk). › Extensive testing and software development in C/C++, Python and MATLAB. <p>C++ C Python Physics-Based Animation Mathematical Modelling MATLAB Pixhawk Embedded Systems Sensors</p>
Dec 2017	Flight Dynamics and Control Engineer, ARISTOTLE SPACE & AERONAUTICS TEAM (ASAT),
Oct 2016	<p>As principal Flight Dynamics and Control Engineer at ASAT (part of EUROAVIA), I was responsible for :</p> <ul style="list-style-type: none"> › The design and sizing of UAV's empennage and control surfaces for it's participation in Air Cargo Challenge (Aeronautical Engineering Competition). › The evaluation of UAV's static and dynamic stability characteristics and implementation of flight simulations using FlightGear and MATLAB. › Design, construction and programming of measuring devices for the experimental evaluation of the mathematical models. › Training of the new members of the flight dynamics department. <p>C++ C Python Physics-Based Animation Mathematical Modelling MATLAB</p>

SKILLS

Programming	C/C++, Python, MATLAB/Octave, GLSL.
Libraries/Frameworks	OpenCV, OpenGL, CUDA, OpenMP, Unreal Engine 4, ROS, Gazebo, Eigen/Armadillo, ThreeJS, Arduino, Simulink.
Software Development Tools	CMake, git, Docker, VSCode, Vim, Valgrind.
Operating Systems	Linux, Windows.
CAD	Inventor Autodesk, Fusion360, Blender.
Word Editors	LaTeX, Pack Office(Word, Excel, PowerPoint).
Soft body simulation	FEM, XFEM, PBD, XPBD, Ansys, MSC Adams.
Control theory	PID, LQR, MPC/Trajectory Optimization, System Identification(e.g. SiNDY, DMD), Adaptive Control.
Optimization	Sequential Quadratic Programming, Newton Methods, Interior-point method, NLPs, Automatic Differentiation.

Apart from software development, I have extensive experience with the mathematical modelling of physical systems. My interests mainly focus on computational mechanics including the dynamics of rigid, multibody and deformable systems. Over the years, I have used and developed software for solving, analyzing and visualizing such systems. Examples of these tools are numerical solvers for both ODEs and PDEs, efficient collision detection algorithms (e.g spatial hashing, KD-trees), rendering software (OpenGL) and

constraint methods for contact handling.

Further activities include the development of motion tracking and computer vision algorithms using OpenCV and depth cameras, the design of control algorithms for linear and nonlinear applications (MPC, LQR, Sliding Mode, Feedback Linearization) and the development of optimization algorithms for robotic system applications.

TEACHING AND MENTORING

Oct 2020 Dec 2021	Teaching assistant, ROBOTICS AND CONTROL, University of Bristol <ul style="list-style-type: none">> Forward and inverse kinematics of robotics manipulators.> Dynamics and control of robotics manipulators> Nonlinear control theory. <div>Robotics and Control</div> <div>Nonlinear control theory</div>
Oct 2018 Dec 2018	Teaching assistant, MULTIVARIATE CONTROL THEORY, Aristotle University of Thessaloniki <ul style="list-style-type: none">> Linear quadratic regulators.> Gain scheduling.> Feedback linearization. <div>Multivariate control</div> <div>Nonlinear control theory</div>