NICHOLAS PARNENZINI

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RESEARCH INTERESTS

Computer Architecture, Hardware Acceleration, Compilers, Parallel Computing

RESEARCH EXPERIENCE

Master's Thesis. I have developed a dynamic framework in which an external attacker can tamper with the control input and affect the system stability. As a function of the security mechanisms implemented on the cyber-physical system, this method computes the probability that the attacker may render the system unstable through a sequence of malicious control inputs, effectively creating a security map for the system state space. The proposed method is illustrated for the case of a UAV.

iNEMO. Attitude estimation of a low-cost Inertial Measurement Unit (IMU) provided by STMicroelectronics, called iNEMO. I have developed a C/MATLAB application which is able to estimate the roll, pitch and yaw angles by receiving data from sensors via serial communication. I have implemented the Madgwick filter for this scenario and compared its performance to a simpler attitude estimation algorithm provided by STMicroelectronics.

Variable Stiffness Actuators in Gazebo/ROS. In this research project I have developed a C++ plugin in Gazebo/ROS for a specific group of Variable Stiffness Actuators, called qbmoves. This simulator also includes the implementation of the two servo-motors that are embedded in each qbmove.

Bachelor's Thesis. I have implemented a Hardware-In-The-Loop (HIL) simulator for an autopilot, which is a 32-bit microcontroller called ICARO II. The developed application used to simulate the real system (quadcopter) has been written in C++ and embedded in a C function in Simulink. The CAN bus has been used for communication between the application and the autopilot.

WORK EXPERIENCE

Graduate Research Assistant, Georgia Institute of Technology *(Atlanta, US)*　　　　Aug 2023 - Present
PhD in Computer Science, with a focus in Computer Architecture and Compilers.

Senior Software Engineer, Arm Ltd *(Cambridge, UK)*　　　　Apr 2021 - Aug 2023
I was involved in the the design, implementation and testing of functional models for the next generation of Mali GPUs. I have developed several instructions in C++/LLVM for the next Mali GPU functional models as well as adding tests for edge cases for those implemented instructions.

Software Engineer, Arm Ltd *(Cambridge, UK)*　　　　Aug 2018 - Mar 2021
C++ developer of debugging tools in the Fast Models team. Achievement highlights:

- Technical leader for one of the software debugging tools, called Iris, shipped together with the functional models. This included the design and implementation of new features as well as fixing software bugs when needed.

- Designed and developed the backend API for the Performance Database of Fast Models, which is used by our internal team to monitor the simulation performance of functional models shipped to customers.

- Improved the quality of automated tests by either rewriting or fixing them, as well as writing new ones when needed.

Application Support Engineer, MathWorks Ltd *(Cambridge, UK)*　　　　May 2017 - Aug 2018

- Collaborated on internal feature development projects (C++, MATLAB).

- Developed proof of concept examples to illustrate the value of MathWorks products to potential customers, in collaboration with Application Engineers (ROS/Gazebo, MATLAB).

- Helped customers solving technical issues while using MATLAB and Simulink.

Software Engineer, SCISYS GmbH *(Bochum, Germany)* Mar 2016 - Apr 2017

My role as a Software Engineer at SCISYS included a nine-month stay in Toulouse (France) as a Software Verification Engineer at Thales Alenia Space. I mainly worked on analysis and detection of software anomalies in GACF, a key component of the Ground Mission Segment in Galileo, the European Global Positioning System.

Apprentice, Embit srl *(Modena, Italy)* Feb 2016

Contributed to the development of firmware for embedded devices

EDUCATION

PhD in Computer Science Aug 2023 - Present

Georgia Institute of Technology

Master's Degree in Robotics and Automation Engineering Oct 2012 - Nov 2015

University of Pisa *Final Score*: 110/110

Master's Thesis Mar 2015 - Jul 2015

University of California, Riverside

Thesis: *"An Advanced Security Mechanism for Cyber-Physical Systems"*

Bachelor's Degree in Computer Engineering Sept 2009 - Oct 2012

University of Pisa *Final Score*: 110/110 cum laude

Thesis: *"Hardware-in-the-loop simulator for autopilot based on CAN bus"*

HONORS AND AWARDS

Excellence Award, *University of Pisa* May 2013

PUBLICATIONS

R. Mengacci, G. Zambella, G. Grioli, D. Caporale, M. G. Catalano, A. Bicchi, (Acknowledgments: **N. Parnenzini**), *"An Open-Source ROS-Gazebo Toolbox for Simulating Robots With Compliant Actuators"*, Journal of Frontiers in Robotics and AI, August 2021.

L. Pollini, **N. Parnenzini**, M. Innocenti, *"Distributed Real-Time Hardware and Man-in-the-loop Simulation for the ICARO II Unmanned Systems Autopilot"*. Proceedings of the 1st WSEAS Conference on Information Technology and Computer Networks, WSEAS 2012

TECHNICAL SKILLS

Operating Systems: Windows, Linux
Programming Languages: C/C++, Python, Arm Assembly, Java
Tools & Libraries: SystemC, LLVM, OpenGL, Git, Vim, ROS, Gazebo, MATLAB, Simulink
Devices: iNEMO-M1, STM32F4x, Arduino, MSP430