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EMANUEL BRENAG

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FORMAL EDUCATION

Universidade Federal de Minas Gerais	Belo Horizonte, Brazil	Jun 2025 – ongoing
<ul style="list-style-type: none">• Ph.D. in Electrical Engineering, GPA: 5.00/5.00.• Transferred directly from Masters to PhD Program in June, 2025, due to distinguished academic performance.• <i>Qualifying Exam</i>: Distributed output-feedback protocols for nonlinear multi-agent systems - polytopic approaches• <i>Research topics</i>: Data-Driven Control, Fault-tolerant Control, Multi-agent systems, Nonlinear systems, Takagi-Sugeno fuzzy systems• <i>Advisor</i>: Prof. Reinaldo Martinez Palhares.		
Universidade Federal de Minas Gerais	Belo Horizonte, Brazil	Mar 2024 – Jun 2025
<ul style="list-style-type: none">• M.Sc. in Electrical Engineering, GPA: 5.00/5.00.• <i>Thesis</i>: Quasi-Data-Driven Static Output-feedback Control of Linear Discrete-Time Delay Systems.• <i>Advisor</i>: Prof. Reinaldo Martinez Palhares.• <i>Relevant Coursework</i>: Nonlinear Control, Fuzzy Control Systems, Nonlinear Dynamical Systems, Reinforcement Learning.		
Georgia Institute of Technology	Atlanta, United States	Aug 2023 – Feb 2024
<ul style="list-style-type: none">• M.Sc. in Aerospace Engineering.• <i>Relevant Coursework</i>: Multivariable Linear Systems and Controls, Optimal Guidance and Control.• Incomplete - Transferred to the Federal University of Minas Gerais		
Universidade de Brasília	Brasília, Brazil	Mar 2018 – Dec 2022
<ul style="list-style-type: none">• B.Sc. in Control and Automation Engineering, GPA: 4.73/5.00• Top Student of the Class of 2022.• <i>Final Project</i>: Analysis and investigation of techniques for satellite attitude reconstruction based on in-orbit data.• <i>Advisor</i>: Prof. Renato Alves Borges.• <i>Relevant Coursework</i>: Control of Dynamic Systems, Linear Systems Theory, Digital Control, Spacecraft Attitude Dynamics and Control, Discrete Event Systems, System Software, Computer Organization and Design, Data Structures, Real-Time Operating Systems, Electric Circuits 1, Electric Circuits 2, Electronics, Instrumentation for Control.		

AWARDS AND HONORS

- Brazilian Society of Automatics' Best Student Paper Award at the 17th Brazilian Symposium on Intelligent Automation, 2025.
- Fellowship for Academic Excellence Program (PROEX), sponsored by the Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES), 2024.
- **Honor of Merit Award for the highest GPA in the Control and Automation Engineering Class of '22 of the University of Brasilia, 2022.**
- Honorable Mention Award at the 28th Scientific Initiation Congress of UnB and 19th Congress of Scientific Initiation of Federal District, 2022.
- Fellowship for Scientific Initiation, sponsored by the National Council for Scientific and Technological Development (CNPq), 2021. **(Ranked 1st in the selection among all STEM students of the University)**
- Honorable Mention Award at the 27th Scientific Initiation Congress of UnB and 18th Congress of Scientific Initiation of Federal District, 2021.
- Honorable Mention Award at the 1st Federal District Mathematical Olympiad, 2017
- Honorable Mention Award at the 13th Brazilian National Mathematical Olympiad, 2017
- Silver Medal at the 15th Brazilian National Astronautics and Astronomy Olympiad, 2012.
- Bronze Medal at the 7th Brazilian National Mathematical Olympiad, 2012

SELECTED SKILLS

Languages

English (fluent); French (Upper-intermediate); Portuguese (native); Spanish (Upper-intermediate).

Programming

C++ (Catch2/ Boost/ STL); C; Matlab; Python (Pandas/ Numpy/ Pytest/ SQLAlchemy); RISC-V assembly; SQL.

General engineering tools

STK (Level 1); Simulink; Gpredict; LaTeX; SolidWorks; Autodesk Fusion 360; LTspice; Embedded GNU/Linux systems; Git.

RESEARCH AND INDUSTRIAL EXPERIENCE

Autotrac

02/2023 – 08/2023

Software Engineer

- Spearheaded improvements to the flagship application (Supervisor®), a satellite-based vehicle tracking distributed system, ensuring high availability, reliability, and optimal performance.
- Conducted comprehensive maintenance and performance optimizations, successfully refactoring legacy code to align with modern C++ standards and industry best practices.
- Streamlined development processes by deploying Continuous Integration and server monitoring systems, leveraging Docker containers for deployment and management.
- Implemented robust unit and integration testing frameworks, resulting in enhanced code quality and increased software reliability.
- Utilized concurrent programming techniques such as threads, semaphores, monitors, and more to optimize application performance and responsiveness.
- Implemented interprocess communication mechanisms using sockets, pipes, and other technologies to enable seamless communication between application components.

Laboratory of Simulation and Control of Aerospace Systems, *University of Brasília*

04/2021 – 03/2023

Undergraduate Research Fellow

- Hardware-in-the-loop tests for attitude estimation and control by magnetic actuation.
- Implementation of optimization and stochastic filtering algorithms to estimate the attitude of the AlfaCrux satellite.
- Assembly and operation of the LODESTAR ground station.

International Center of Condensed Matter Physics, *University of Brasília*

06/2020 - 06/2021

Undergraduate Research Assistant

- Analytical solution of the noncommutative Schrodinger equation for Coulomb potential.
- Determination of the energy levels for the Hydrogen Atom and comparison with experimental data.
- Estimation of a bound on the noncommutativity parameter using the results and experimental data.

E-lastic

02/2022 – 06/2022

Hardware Development Intern

- Hardware development, testing and manufacturing for IoT applications and automations.
- Development and execution of test protocols for the dynamometer PCBs, batteries and load cells (post R&D).
- Documentation and updating of assembly processes, diagnosis and maintenance of malfunctioning dynamometers.
- Participation in the assembly processes, quality control and planning of the assembly line layout.
- Firmware development and update for ESP32 and Nordic NRF52832.

TEACHING EXPERIENCE

Dept. of Electronics Engineering

Federal University of Minas Gerais

- 2024 – ongoing Guest lecturer in Control of Linear Systems
- 2025 – ongoing Teaching assistant in Control of Linear Systems
- 2024 Teaching assistant in Feedback Control Laboratory

School of Mechanical Engineering

Georgia Institute of Technology

- 2023 Teaching assistant in Introduction to Engineering Graphics and Visualization

Dept. of Electrical Engineering

University of Brasília

- 2022 – 2023 Teaching assistant in Digital Control
- 2021 Teaching assistant in Feedback Control of Dynamic Systems
- 2020 Teaching assistant in Electric Circuits 1

Dept. of Mathematics

University of Brasília

- 2018 Teaching assistant in Single Variable Calculus

PEER-REVIEWED CONFERENCE PROCEEDINGS

- **E. C. BRENAG**, P. S. P. PESSIM, P. M. DE OLIVEIRA, R. M. PALHARES, "Controle baseado em dados para sistemas lineares sujeitos a retardo no tempo na entrada", in *Proc. of the 17th Brazilian Symposium on Intelligent Automation*, São João del Rei, Brazil, 2025. (in portuguese)
- **E. C. BRENAG**, B. T. DE MELLO, M. L. ARRUDA, R. A. BORGES, M. Y. OVCHINNIKOV, D. IVANOV, AlfaCrux CubeSat Magnetic Dipole Determination and Attitude Motion Estimation Using Magnetometer Measurements Only", in *Proc. of the 74th International Astronautical Congress*, Baku, Azerbaijan, 2023.
- **E. C. BRENAG**, B. T. DE MELLO, M. L. ARRUDA, R. A. BORGES, D. IVANOV, U. MONAKHOVA, Y. MASHTAKOV, M. Y. OVCHINNIKOV, "Magnetic parameters estimation and Attitude Motion reconstruction using in-flight magnetometer measurements of the AlfaCrux CubeSat", in *Proc. of the IAA 3rd Latin American Symposium on Small Satellites*, Brasília, Brazil, 2022.
- R. A. BORGES, D. IVANOV, Y. C. FERREIRA, D. ROLDUGIN, M. Y. OVCHINNIKOV, G. B. GUERRA, M. L. ARRUDA, L. L. ANDRADE, E. C. BRENAG, "Analysis of Sun-acquisition Magnetic Attitude Control for Nanosatellite Using a Hardware-in-the-loop Satellite Simulator", in *Proc. of the 73rd International Astronautical Congress*, Paris, France, 2022.
- A. L. S. AGUIAR, A. V. R. DIAS, B. C. B. PINHO, E. C. BRENAG, I. K. M. BRANDÃO, J. B. SILVA, W. R. SILVA, "Educational Attitude Determination Control System Prototype for CubeSats", in *Proc. of the 26th International Congress of Mechanical Engineering*, Florianópolis, Brazil, 2021.

PEER-REVIEWED JOURNAL PUBLICATIONS

- **E.C. Brenag**, P.S.P. Pessim, P.M. de Oliveira, R.M. Palhares, "Input saturated control of time-delay systems: a data-driven approach". *International Journal of Systems Science*, Taylor & Francis, 2026.
- **E.C. Brenag**, P.S.P. Pessim, P.M. de Oliveira, R.M. Palhares, "Quasi-Data-Driven Static Output-feedback Control of Linear Systems with Input and State delays". *European Journal of Control*, Elsevier, v. 86, p. 101385, 2025.
- R.A. Borges, A.C. dos Santos, W.R. Silva, L. Aguayo, G.A. Borges, M.M. Karam, R.B. de Sousa, B.F.A. García, V.M.d.S. Botelho, J.M. Fernández-Carrillo, J.M. Lago Agra, F.A. Agelet, J.V.Q.S. Borges, A.C.A. de Oliveira, B.T. de Mello, Y.d.C.F. Avelino, V.F. Modesto, E.C. Brenag, "The AlfaCrux CubeSat Mission Description and Early Results", *Appl. Sci.*, vol. 12, no. 19, pp. 9764, 2022.
- B. C. Wang, E. C. Brenag, R. G. G. Amorim, S. C. Ulhoa, V. C. Rispoli, "The noncommutative Coulomb potential", *Int. J. Mod. Phys. A*, vol. 36, no. 16, pp. 2150094, 2021.
- B. C. Wang, E. C. Brenag, R. G. G. Amorim, S. C. Ulhoa, V. C. Rispoli, "Exact Noncommutative Two-Dimensional Hydrogen Atom", *Adv. High Energy Phys.*, vol. 2021, no. 1, pp. 5562179-5562183, 2021.

JOURNAL SUBMISSIONS UNDER REVIEW

- **BRENAG, E. C.**; PESSIM, P. S. P.; PALHARES, R. M. "Distributed output-feedback consensus of LPV multi-agent systems: Static and Dynamic protocols". 2025;
- **BRENAG, E. C.**; PESSIM, P. S. P.; PEIXOTO, M. L. C.; PALHARES, R. M. "Distributed static output-feedback consensus for Takagi-Sugeno fuzzy multi-agent systems". 2025;
- de OLIVEIRA, P. M.; **BRENAG, E. C.**; SANTOS, V. G.; COUTINHO, P. H. S.; BESSA, I.; PALHARES, R. M. "Data-driven fault-hiding for linear systems subject to input saturation". 2025;
- de OLIVEIRA, P. M.; SANTOS, V. G.; **BRENAG, E. C.**; COUTINHO, P. H. S.; BESSA, I.; PALHARES, R. M. "Data-driven SOF for systems with disturbances and noisy measurements". 2025;
- SANTOS, V. G.; de OLIVEIRA, P. M.; **BRENAG, E. C.**; COUTINHO, P. H. S.; BESSA, I.; PALHARES, R. M. "Dynamic output feedback control with reference tracking: a quasi-data-driven approach". 2025;
- **BRENAG, E. C.**; DE MELLO, B. T.; ARRUDA, M. L.; BORGES, R. A.; IVANOV, D.; OVCHINNIKOV, M. Y. "AlfaCrux Nanosatellite Attitude Motion and Residual Magnetic Dipole Estimation Using In-Flight Magnetometer Measurements". *Advances in Space Research*, 2025.