**Devasmito DAS**

# Fractional Calculus, Nonlinear Systems, Chaos, Control Algorithms, Deep Learning, Reinforcement Learning

Welcome to my portfolio! I'm a PhD researcher exploring Fractional Calculus, Nonlinear Dynamics, and Chaos, focusing on advanced Control through Classical, Deep, and Reinforcement Learning approaches!

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## Core business

*PHASE 3* **Skill development**

I developed professional skills by setting ambitious goals, including publishing 8+ papers in IEEE/IFAC and applying fractional control to robotics, bridging theory and practice. I systematically expanded my expertise from electrical engineering to fractional calculus, chaos theory, and reinforcement learning through 80+ hours of advanced courses and research. Leveraging a bi-national supervisory team and industry partners, I gained 48 hours of professional project experience. I transferred knowledge across robotics, gait dynamics, and industrial projects, pursued a dual-degree program, became fluent in 3 languages, and integrated mentorship via 35+ hours of training and science communication, enhancing leadership and interdisciplinary adaptability.

*PHASE 3* **Evaluation**

I developed critical evaluation and peer review skills by systematically assessing literature across fractional calculus, chaos, and reinforcement learning, publishing 8+ papers in IEEE, IFAC, and Springer venues. I critically refined my own research—from theoretical fractional MPC to hexapod control — ensuring methodological rigor and validation. Presenting at international conferences and teaching 96+ hours exposed me to diverse critical audiences. I contributed as a peer reviewer for conferences and evaluated 48 hours of industrial projects, strengthening objective judgment, technical assessment, and scientific reasoning essential for research excellence.

*PHASE 3* **Expertise and methods**

I have driven high-impact innovations by developing novel control schemes for fractional chaotic oscillators, now referenced in international journals and conferences. My dual-degree research at École Centrale de Nantes and IIT Madras, along with conferences at IFAC and IEEE, establish me as a prominent enthusiast in fractional nonlinear dynamics. Leveraging strategic insight into emerging trends, I have designed interdisciplinary projects linking robotics, biomechanics, and AI, developed tools like a modular time-delay feedback framework, and coordinated multi-partner programs with SAINT-GOBAIN, VEOLIA, and EXPLEO to advance collaborative research and innovation.

## Personal and relational qualities

*PHASE 3* **Communication**

I frequently present talks on key challenges in fractional control and nonlinear dynamics at IEEE and IFAC forums. I deliver tailored presentations — from technical lectures for academics to accessible webinars for industry-related projects — through journals, LinkedIn, and presentations. Fluent in English and French, I manage international research collaborations and funding negotiations. Proactively, I participated in workshops and public outreach programs organized by my advisors for general audiences and high school students, contributing expert commentary to

national science programs and broadening the impact and visibility of my expertise.

### PHASE 3 Collaboration

I maintain a diverse professional network across academia and industry, leveraging my dual affiliation with École Centrale de Nantes and IIT Madras to connect with leading research groups globally. I forge collaborations with organizations like SAINT-GOBAIN, VEOLIA, and EXPLEO on control systems and robotics projects. Engaging international societies (IFAC, IEEE), industry consortia, and startup incubators, I mobilize resources, share expertise, and present research ideas that advance the development and application of fractional-order systems.

### PHASE 3 Analysis, synthesis and critical thinking

I have pioneered integrating fractional calculus with chaotic system control, introducing novel time-delay feedback and FMPC frameworks that challenge conventional integer-order paradigms. I support these innovations with rigorous proofs, simulations, and comparative analyses, tailoring presentations for both theoretical specialists and applied engineers. Through focused workshops and detailed case studies, I build consensus, and addresses critical questions of collaborators, and mentors, promoting the adoption of his groundbreaking methods.

### PHASE 3 Open-mindedness and creativity

I have explored beyond control theory, integrating insights from biomechanics, robotics, and signal processing to design novel fractional control schemes. I have both embraced and challenged integer-order norms, rigorously testing time-delay feedback and FMPC methods. To drive creativity, I have led interdisciplinary coding sprints in MATLAB/Python, merging neural networks with fractional dynamics. Promoting an open, inclusive lab culture across France and India, he uses collaborative tools like GitHub and shared Jupyter notebooks with structured ideation prompts, peer feedback loops, and metadata tagging to foster intercultural dialogue and sustained innovation. In addition, I am currently working on quantum optimal control problems.

### PHASE 3 Commitment

Initially uncertain about my research direction, I advanced with the fractional Rössler oscillator, later expanding to other nonlinear systems. I articulated a clear vision for advancing fractional-order control, even when early simulations failed to converge, motivating my committee and peers to refine algorithms instead of abandoning them. Viewing setbacks like numerical instability in Grünwald–Letnikov methods as learning opportunities, I maintained team morale. By celebrating progress through IEEE, CHAOS and IFAC publications and empowering juniors with ownership of experiments, I transformed challenges into shared achievements that fostered resilience and collaboration.

### PHASE 3 Integrity

I have fostered a culture of respect and integrity by embedding clear ethical guidelines across all team activities, from data handling to authorship. In lab meetings, I promote discussions on research ethics, stressing proper citation, code transparency, and fair credit along with my advisors. When a member misquoted a source, I addressed it through private guidance and updated the shared reference checklist and I did the same when it was addressed to me. Underwent doctoral school training on ethics and scientific integrity, focusing on data management and reproducibility, and implemented code reviews and version-control audits. By modeling accountability and openness, he ensures ethics underpin every stage of research.

### PHASE 3 Negotiation

I have successfully negotiated complex collaborations at national and international levels. Leveraging his dual affiliation with École Centrale de Nantes and IIT Madras, I secured a joint research grant co-funded by French and Indian agencies, aligning deliverables with each funder’s priorities. I negotiated project terms with SAINT-GOBAIN and VEOLIA, balancing publication rights and confidentiality, and structured a development contract with EXPLEO to deploy fractional-order control solutions. Fluent in English and French, I led cross-border talks to harmonize milestones, and funding schedules, ensuring mutual benefit and lasting partnerships.

## Business management and value creation

PHASE 2

### Decision-making

I balance technical performance with market needs for cost, simplicity, and scalability. In developing a fractional-order control module for hexapod locomotion, I selected a lower controller order to reduce computational load, meeting real-time constraints while retaining over 90% tracking accuracy. I documented this trade-off in design reviews. When simulation showed latency under hardware limits, I revised the design with a larger discretization step and simplified time-delay loop, improving performance by 15%. I maintain transparent records, communicates impacts, and adapts decisions to empirical results and market feedback.

PHASE 3

### Producing results

I spearheaded the transition of my fractional-order control algorithms from academic prototypes to industrial pilot deployments. Collaborating with SAINT-GOBAIN and VEOLIA, I led the full innovation cycle—defining product requirements, co-designing hardware–software integration, overseeing prototyping on embedded platforms, and coordinating validation trials. Through structured project management with EXPLEO engineers, I ensured timely delivery of a market-ready control solution prepared by students tutored by me. Apart from that, the successful translation of research to application gained recognition at IFAC and IEEE forums, strengthening my reputation in fractional nonlinear dynamics and control innovation.

## Strategy and Leadership

PHASE 2

### Strategy

I continuously monitor emerging research and industry trends — tracking preprints on fractional dynamics, AI-control hybrids, and feedback from different distinguished researchers along with my advisors to identify weak signals and micro-trends. From these insights, I developed a framework combining time-delay feedback with reinforcement-learning–augmented FMPC. I participated in weekly and fortnightly brainstorming sessions and maintain a shared “Trend & Innovation Brief” highlighting research opportunities and strategic directions. These briefs align projects with goals in robotics and process control, helping the project group to connect creativity with strategy and ensuring every initiative reflects both academic progress and market relevance.