Renan Bomtempo

M.Sc. Mathematics Student

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PRINCIPAL INTERESTS

research and development | applied mathematics | computer simulation | software development | numerical analysis | differential equations | adaptive mesh refinement | computer graphics | interactive applications | scientific computing | high performance computing | data visualization

EDUCATION

M.Sc. Mathematics

Federal University of Minas Gerais (UFMG)

Mar 2024 - Mar 2026 (Planned) — Belo Horizonte, Brazil

- Researching numerical methods and meshing algorithms for solving hyperbolic partial differential equations.
- Full CAPES scholarship.

B.Sc. Computational Mathematics

Federal University of Minas Gerais (UFMG)

Mar 2018 - Dec 2023 — Belo Horizonte, Brazil

- Studied pure and applied mathematics as a foundation for modelling problems while also acquiring a deep understanding of computer science to ensure the problem's tractability using computational methods and tools.

EXPERIENCE

Software Developer

Center for Remote Sensing, UFMG

Dec 2020 – Jan 2023 — Belo Horizonte, Brazil

- Python scripts for automating tasks and integrating systems.
- PostgreSQL database management and AWS resources management.
- C++ development of Dinamica EGO, a simulation software for environmental modelling.

Undergraduate Researcher: Implementation of a Lagrangian-Eulerian Interactive Solver for Hyperblic Conservation Laws

Mathematics Department, UFMG

Oct 2022 – Oct 2023 — Belo Horizonte, Brazil

- Implemented a C++ interactive solver for 1-dimensional hyperbolic conservation laws based on a Lagrangian-Eulerian approach and showed that numerical diffusion is reduced when multiple Lagrangian evolutions are performed before the Eulerian remap.
- Professor Advisors: Denise Bulgarelli, Luccas C. Campos and Eduardo Abreu.

Undergraduate Researcher: Numerical Simulation of the Shallow Water Equations Using an Adaptive Mesh

Mathematics Department, UFMG

Oct 2021 – Oct 2022 | Belo Horizonte, Brazil

- As a follow up of the previous year's research the Nodens Engine was developed, a interactive numerical simulation framework for solving the Shallow Waters equations using the *Autonoums Leaves Graph* data structure as an adaptive mesh strategy. [presentation video] [poster]
- Professor Advisor: Denise Bulgarelli.

Undergraduate Researcher: Introduction to Computational Fluid Dynamics: The Shallow Water equations

Mathematics Department, UFMG

Sep 2020 – Oct 2021 | Belo Horizonte, Brazil

- A study was conducted on the derivation of the Shallow Waters model as a special case of the Navier-Stokes equations, as well as an explicit numerical scheme based on the method of characteristics. [presentation video] [poster]
- Professor Advisor: Denise Bulgarelli.

PROGRAMMING LANGUAGES AND TOOLS

c++11 | c11 | python3 | cmake | imgui | opengl | pthreads | aws ec2 | aws s3

ACADEMIC AWARDS

PRPq's XXXI Scientific Initiation Week, 2022
Awarded the *Academic Relevance* award for the project "Numerical simulation of the Shallow Water equations using an adaptive mesh".

PRPq's XXX Scientific Initiation Week, 2021
Awarded the *Academic Relevance* award for the project "Introduction to Computational Fluid Dynamics: The Shallow Water equations".

PERSONAL PROJECTS

Nodens Engine

Real-Time Numerical Simulation Engine

- A C++ framework to help researchers develop efficient interactive numerical simulations with a graphical user interface and 2D graph plotting.
- Made using GLFW, OpenGL, DearImGui and ImPlot.

Boids

College Course Project

- 3D boids simulation written from scratch using C++ and OpenGL. [demo video]

Polygon Wind

Unity Shader

- A shader written in Unity's HLSL to emulate organic wind effects on low polygon assets, such as trees and foliage.
- Having over 160 stars on GitHub it has helped hundreds of game developers since its release in 2018.