

DAVI COLLI TOZONI

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INTERESTS

Computer Graphics, Optimization, Digital Fabrication, Robotics, Algorithms, Computational Geometry, Software Development

PROFESSIONAL EXPERIENCE

New York University, New York, NY, USA

Sept 2016 - present

Research Assistant - Full-time doctoral student conducting research in Computer Graphics, especially in Structural and Shape Optimization, Microstructures, Digital Fabrication and Soft Robotics. Advised by Prof. Denis Zorin.

- **Soft Bodies/Robotics Optimization:** designed computational framework for optimizing shape, material properties and initial configuration of soft bodies/robots. Our model, which includes contact and friction forces, allows for realistic simulation of dynamic elastic problems
- **Contact-based assemblies Optimization:** developed algorithm and code that optimizes shape of multi-piece objects aiming to reduce stress concentrations, while keeping pieces easy to assemble. Optimized objects can be more than 10x stronger, verified both in simulations and 3D-printed physical experiments
- **Microstructure Mapping and Optimization:** designed technique to smoothly map material properties to microstructure geometry, which allows us to build compliant 3D-printable objects using a single material from curved and non-regular quad meshes. Our technique was compared to other state-of-the-art techniques, showing significant better results
- Developed software applications to run optimization and simulation algorithms in Python, C++, Matlab
- Executed and analyzed large sets of simulation and optimization experiments on HPC servers
- Planned and executed physical experiments involving 3D modeling and printing
- Worked in six different research projects, with varying sizes (2 to 7 people)
- First author in two SIGGRAPH papers and lead researcher in two ongoing projects

nTopology, New York, USA

Jun 2021-Aug 2021, Sept 2020-Dec 2020, Jun 2019-Aug 2019

Software Engineer Intern - working with the Simulation Team

- Digital Fabrication and Structural Optimization research, focused on Microstructures and Shape/Topology Optimization
- Built research prototypes in Python and C++ for new tools to be integrated with nTopology software
- Two projects resulted in drafts to be submitted to SIGGRAPH; third project now under active development and will be added to nTopology platform

Schlumberger, Rio de Janeiro, Brazil / Oslo, Norway

Jul 2014 - Apr 2016

Software Engineer

- Designed features for uncertainty and optimization (U&O) and geophysical processes inside Petrel E&P Platform in C#
- Built data visualization tools for optimization/simulation results
- Optimized memory use and performance of software, resulting in 2-10x speedup
- Automated integration tests using UI interface (C#), being able to reach almost 100% test coverage for the geoscience process functionalities and enabled 10x more frequent testing of codebase

Technische Universität Braunschweig (TUBs), Braunschweig, Germany

Aug 2013 - Oct 2013

Research Intern - supervised by Prof. Alexander Kröllner

- Developed new algorithm/code with researchers from University of Campinas and TUBs, which is currently the state-of-the-art technique for optimally solving the Art Gallery Problem, being able to solve instances of 5000 vertices in less than 20 min
- Resulted in paper (survey) comparing algorithms for the Art Gallery Problem: [Engineering art galleries](#)

University of Campinas (Unicamp), São Paulo, Brazil

Mar 2011 - Jul 2014

Research Intern - Full-time master's student working in research in Computational Geometry and Combinatorial Optimization. Advised by Prof. Cid Carvalho de Souza and Prof. Pedro Jussieu de Rezende

- Developed new algorithm and software solution in C++ for optimally solving the Art Gallery Problem (AGP)
- New algorithm is able to find guaranteed optimal solutions for instances of thousands of vertices in a matter of minutes, something not possible before, when algorithms had issues with polygons of dozens of vertices
- Web page: www.ic.unicamp.br/~cid/Problem-instances/Art-Gallery/

Kryptus, São Paulo, Brazil

Apr 2010 - Jul 2012

Software Developer / Team Leader

- Developed software solutions related to cryptographic engineering and computer security

Petrobras / Unicamp, São Paulo, Brazil

Aug 2008 - Mar 2010

Research Intern

- Worked in research in Operational Research and Combinatorial Optimization
- Developed algorithm and software in C++ for scheduling oil products in a pipeline network

EDUCATION

New York University, New York, NY

Sept 2016 - present

PhD Candidate in Computer Science (4.0/4.0)

New York University, New York, NY

Sept 2016 - Dec 2021

MPhil in Computer Science (4.0/4.0)

University of Campinas (Unicamp), São Paulo, Brazil

Mar 2011 - Jul 2014

Master's Degree in Computer Science (4.0/4.0)

University of Campinas (Unicamp), São Paulo, Brazil

Mar 2006 - Dec 2010

Bachelor's Degree in Computer Engineering (0.91/1.0)

- Class rank: 1st out of 98 students
- Focused in Algorithm Engineering and Software Development

PUBLICATIONS

- **D. C. Tozoni**, Y. Zhou, D. Zorin. [Optimizing contact-based assemblies](#). ACM Transactions on Graphics (TOG) 40, 6, Article 269, December 2021.
- **D. C. Tozoni**, J. Dumas, Z. Jiang, J. Panetta, D. Panozzo, D. Zorin. [A low-parametric rhombic microstructure family for irregular lattices](#). ACM Transactions on Graphics (TOG) 39, 4, Article 101, July 2020.
- Ostanin, G. Ovchinnikov, **D. C. Tozoni**, D. Zorin. [A parametric class of composites with a large achievable range of effective elastic properties](#). Journal of the Mechanics and Physics of Solids, Volume 118, 2018, Pages 204-217.
- P. J. de Rezende, C. C. de Souza, S. Friedrichs, M. Hemmer, A. Krölller, and **D. C. Tozoni**. [Engineering art galleries](#). In Algorithm Engineering: Selected Results and Surveys, pages 379-417. 2016. Springer.
- **D. C. Tozoni**, P. J. de Rezende, and C. C. de Souza. [Algorithm 966: A practical iterative algorithm for the art gallery problem using integer linear programming](#). ACM Transactions on Mathematical Software, 43(2):16:1-16:27. 2016.
- **D. C. Tozoni**, P. J. de Rezende, and C. C. de Souza. [The quest for optimal solutions for the art gallery problem: A practical iterative algorithm](#). In Proceedings of the 12th International Symposium on Experimental Algorithms, SEA 2013, volume 7933 of Lecture Notes in Computer Science, pages 320–336, Rome, Italy, 2013. Springer.
- D. Borrmann, P. J. de Rezende, C. C. de Souza, S. P. Fekete, S. Friedrichs, A. Krölller, A. Nüchter, C. Schmidt, and **D. C. Tozoni**. [Point guards and point clouds: solving general art gallery problems](#). In Proceedings of the 29th annual symposium on computational geometry, SoCG'13, pages 347–348, New York, NY, USA, 2013. ACM.

AWARDS

- MacCracken fellowship - PhD studies at NYU
- 1st place in the XXII Latin American Contest of Master Thesis - XLI Latin American Computing Conf. (CLEI 2015) - 2015
- Best Master's Degree Thesis of 2014 - Institute of Computing (Unicamp) – 2015
- CNPq and FAPESP fellowships - Master's studies at Unicamp
- von Neumann Award - Institute of Computing (Unicamp) - 2011
- Graduation with Great Distinction - Institute of Computing (Unicamp) - 2011
- Distinguished Student Award - Brazilian Computer Society (SBC) - 2011
- Institute of Engineering Award - Brazilian Institute of Engineering (IE) - 2011
- Crea-SP Professional Award - Council of Engineering, Architecture and Agronomy (CREA-SP) - 2011
- Honor of Merit - Council of Engineering, Architecture and Agronomy (CREA-SP) - 2011
- Best Undergraduate Research Work of 2009 - Institute of Computing (Unicamp) – 2010
- Petrobras and FAPESP fellowships - Undergraduate studies at Unicamp

TECHNICAL SKILLS

Programming: C, C++, Python, MATLAB, C#, Java, UNIX shell scripting

Geometry and other: CGAL, libigl, NumPy, SciPy, Plotly, Eigen, git, LaTeX, Blender, Paraview, gmsh