Curriculum Vitae

Roman Kogan

Contact information

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Objective

To obtain a position as a **Software Engineer** that would let me apply my experience in **Computational Geometry algorithms** and extensive background in **Mathematics Research**, with emphasis on positions with **real-world impact** and a strong preference for **manufacturing** and **Defense-related applications**.

Education

- **2010 - 2017:** Ph.D. in Mathematics, Texas A&M University

  Area: Geometric Group Theory; advisor: Rostislav Grigorchuk.

  PhD Thesis: *Measures Induced by Automata and their Actions*, available at

  http://romankogan.net/math/KoganThesis.pdf (also in OAKTrust)

- **2005 - 2010:** B.Sc. in Mathematics (Computer Science Minor), SUNY Stony Brook.

Work experience

- **2025** nTop, Inc (formerly, nTopology) - Geometry Team - Senior Software Engineer

  - Unified Curve Object redesign in the context of implicit geometry modeling (driven by signed distance fields):

    - User-facing Kratos Curve Object class
    - Support of concatenation of curves of disparate types
    - Internal C++ Curve classes API (NURBS, Bezier, Polylines, Arcs, ...)
    - Frenet (TNB) and Rotation-minimizing (RMF) frames along curves
    - Curvature, Torsion, etc. along curve
    - Exact computation of derivatives with automatic fallback to numerics

- Planar contours and planar regions ("Profiles")- bounded and unbounded
- Signed distance fields (SDF) for 3D curves and planar regions (as well as "parameter at closest point on curve" queries)
- SDF for tubular neighborhoods
- Curve visualization
- Optional-return API refactoring for crash-proof user-facing operations
- MATLAB prototyping and subsequent productionalizing of numeric methods
- Communicating with the product team, architecture team, customer support, and staff experts to ensure that the final result meets customers' needs while staying within business priorities

- Sweep Module redesign:
  - Computing the correct SDF for a curve sweep operation with arbitrary frame, ensuring the correctness of subsequent boolean operations
  - Extending sweeping operation to arbitrary curve types
  - Direct-to-3D-printing screw and mating nut generator with arbitrary thread profile and tolerance spec

- "Extrude Up To Surface" operation using SDF's (implicit geometry only)

- Signed distance fields for involute gear profiles

- Improvements to debugging tools, user-facing feedback, logging, and to-string serialization utilities

- **2023** Meta, Inc - ARVR - Avatar Team - Senior Software Engineer

  - Creating a parametric PCA-based avatar model from body scans
  - Quaternion-based arcball rotation interface for internal tools

- **2022** Motivital, Inc - Cofounder/TPM

  - FSM-based decision tree form creation tool
  - Decision tree / DAG layout algorithms
  - Optimizing decision trees via Finite State Machine minimization

- **2021** Roblox, Inc (San Mateo, CA) Studio Tools Team - Senior Software Engineer

  - Perspective 3D move/rotate/scale modeling tools
  - Mesh simplification algorithms

- Lua-based CSG parametric modeling

  - TeamCreate moderation improvements

- **2018 - 2020** Google, Inc (Mountain View, CA) GEO - HULK (Semantic Location Mapping) - Software Engineer L4:

  - Infer place visits from WiFi scan data

  - Automatically generate maps from crowdsourced data

  - Hiking trails inference from user-generated data

- **2016 - 2018** Cadence Design Systems(San Jose, CA) Computational Lithography Team - Lead Software Engineer:

  - Custom ORM for SQLite-based file format

  - Distributed computation caching with off-the shelf key-value stores

  - Fast mask corner rounding approximation algorithm

  - Single matrix multiplication Zernike coefficient scaling

  - Fast intensity map biasing

  - Fast process window ellipse computation

- **2014** Microsoft (Redmond, WA)
  SNaP Team - Intern:

  - OVSDB with Microsoft virtual switch schema

Publications

- *On a Basis for the Framed Link Vector Space Spanned by Chord Diagrams*, with Brian Bischof and David Yetter. *JKTR , vol. 18, no. 12, 2009.* http://arxiv.org/pdf/0801.3253

- *Automatic logarithm and associated measures*, with R. Grigorchuk and Y. Vorobets https://arxiv.org/abs/1812.00069

- *On Mealy-Moore coding and images of Markov measures*, with R. Grigorchuk and Y. Vorobets. https://arxiv.org/abs/2102.05539

Software on Github

- NvTrees: computations and visualization in n-dimensional Thompson groups nV;

- ChordDiagrams: basis computation for the ranked vector space of chord diagrams of knots and links.

Mathematical Research Interests

- Geometric Group Theory (finite-state tree automorphisms and measures, Thompson group and its generalizations);

- Knot Theory (finite type invariants, Khovanov homology, Legendrian knots);

- Computational Geometry and Topology.

Talks and Presentations

- **Nov 2018** Talk: *Graphs of Action and the Automatic Logarithm*, Groups and Dynamics seminar, Texas A&M.

- **April 2018** Talk: *Finite state measures.* Zassenhaus Groups and Friends Conference at USF.

- **Nov 2017:** Talk: *Finite-State Automata and Measures.* Graduate Student Seminar, Texas A&M Mathematics department

- **Mar 2017** Poster: *Markov, Sofic and Gibbs measures associated with automaton maps*, YGGT VI, Oxford, UK

- **Feb 2016** Poster: *Measure induced by automata acting on binary trees*, YGGT V, KIT, Germany

- **June 2015** Poster: *Algorithms and Software for Computation in n-dimensional Thompson Groups nV* YGGT IV, Spa, Belgium, and Growth, Symbolic Dynamics and Combinatorics of Words in Groups, Paris, France.

- **March 2014:** Talk: *Getting Closer To Amoebas.* Graduate Student Seminar, Texas A&M Mathematics department

- **April 2010:** Poster: *Proving Bennequin Inequality from Knot Diagrams.* EURECA Poster session, SUNY Stony Brook

- **August 2007:** Talk: *An Orbital Basis for the Framed Link Vector Space of Chord Diagrams* (with B. Bischof). Young Mathematician's Conference at Ohio State University.

Workshops ans Summer Schools

- Trees, dynamics and locally compact groups, Dusseldorf - June 2018

- Fall Workshop in Computational Geometry - November 2011

- IMA 2011 PI Summer Graduate Program: Topological Methods in Complex Systems - July 2011

- Texas Algebraic Geometry Symposium - April 2011

- Fall Workshop in Computational Geometry - October 2010

Teaching Experience

- **2010-2016**: Graduate Teaching Assistant, Texas A&M University

  - **Spring 2016**: MAT 131 (Calculus I) - Instructor of Record
  - **Spring 2012, 2013, 2014:** MAT 152 (Calculus II with MATLAB)
    Duties: Lab and recitation TA: conducting recitations, making and grading weekly quizzes, grading MATLAB assignments.
  - **Fall 2013:** MAT 361 (Euclidean and Non-Euclidean geometry, grading)
  - **Fall 2012:** MAT 439 (Differential Geometry, grading)
  - **Fall 2011:** MAT 151 (Calculus I with MATLAB)
    Duties: Lab and recitation TA.

- Undergraduate Teaching Assistant, SUNY Stony Brook

  - **Spring 2008:** AMS 345 (Computational geometry with Joseph Mitchell, SUNYSB)
    Duties: Grading homework and exams.
  - **Fall 2006:** CSE 150 (Foundations of Computer Science Honors with Michael Bender, SUNYSB)
    Duties: Recitation TA; writing and grading homework assignments.

Undergraduate Research

- **2010:** Legendrian Knots: a simpler proof of Bennequin's theorem (**Advisor**: Olga Plamenevskaya)

- **2009:** Legendrian Knots (**Advisor**: Sergei Tabachnikov)

- **2008:** Conjugacy problem in multi-dimensional Thompson groups nV (**Advisors**: Collin Bleak & Francesco Matucci)

- **2007:** Bases of the space of Vassiliev invariants of links (**Advisor**: David N. Yetter)

Competitions

- **2009 ACM ICPC World Finals**

  Team Honorable Mention

- **2008 ACM ICPC Greater NY region**

  - 1st place team

- **2005 Putnam**

  - Honorable Mention: score of 49 with 73rd place nationwide

Programming Languages

Java, C, C++, C#, Python, Lua, Bash, Mathematica, Matlab.

Spoken Languages

English, Russian, Ukrainian.

Citizenship

USA, Ukraine