Dugan Hammock

Curriculum Vitae

Education

Dugan H@g
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University of Texas, Austin - B.s. Mathematics (2008) University of Massachusetts, Amherst - M.S. Mathematics (2013)

Mathematical Research and Work Experience

Rice University (2006)

With: Prof. Brendan Hassett Researched topics in algebraic geometry, measured log canonical thresholds for plane-curve singularities

Universität Tübingen (2011 - 2014)

With: Prof. Franz Pedit, Prof. Nick Schmidt, Prof. Sebastian Heller, Prof. Lynn Heller Computational geometry, geometric visualization, and 3D animations of Lawson surfaces and other CMC surfaces including Hopf-tori in S³, and constrained Willmore Tori

Quantum Gravity Research (2016 - present)

Mathematician and research scientist, specialized in computational geometry and visualization Lead programmer, managed code repositories and developed Mathematica packages used by the team Research topics included hyperdimensional lattices and their projections, aperiodic tilings and quasicrystals, convex polytopes, discretizations of space-time, cellular automata, guage symmetry physics and quantum physics

Wolfram Summer School (2021, 2022)

Projects relating to plotting and visualizing the evolution of hypergraphs and Wolfram Models Collaborated with fellow students on Penrose Tiling Cellular Automata and Geometric Algebra packages

Artistic Experience

YouTube Channel: https://www.youtube.com/@VJDugan/videos (mostly hypershapes)

Max Cooper - 'Emergence' Audio/Video Set

Animations featuring the sieve of Eratosthenes, Sack's spiral, Riemann Zeta function, and 4D hypershapes https://youtu.be/VFjIk_CnRUM (a lecture by Max Cooper about the 'Emergence' project)

Max Cooper and MAOTIK - 'Hyperform' Project

Experimental immersive 360° dome experience featuring visual elements of hypershapes rendered in real-time Wrote Matlab executable which fed geometric data to the dome's in-house projection software via TouchDesigner Performed on stage alongside DJ and VJ and used joystick controllers to dynamically control the movement of the displayed geometries in response to the music as it was mixed lived https://vimeo.com/234009651 (interview with 'Hyperform' creative team)

Publications

- Dugan Hammock. Visualizing 3-dimensional manifolds. In George W. Hart and Reza Sarhangi, editors, Proceedings of Bridges 2013: Mathematics, Music, Art, Architecture, Culture, pages 551–552, Phoenix, Arizona, 2013. Tessellations Publishing.
- [2] Fang Fang, Dugan Hammock, and Klee Irwin. Methods for calculating empires in quasicrystals. Crystals, 7(10):304, 2017.
- [3] Fang Fang, Sinziana Paduroiu, Dugan Hammock, and Klee Irwin. Non-local game of life in 2d quasicrystals. *Crystals*, 8(11), 2018.
- [4] Dugan Hammock, Fang Fang, and Klee Irwin. Quasicrystal tilings in three dimensions and their empires. Crystals, 8(10):370, 2018.
- [5] Fang Fang, Sinziana Paduroiu, Dugan Hammock, and Klee Irwin. Empires: The nonlocal properties of quasicrystals. In Devinder Singh and Simona Condurache-Bota, editors, *Electron Crystallography*, chapter 3. IntechOpen, Rijeka, 2019.
- [6] Marcelo Amaral, Fang Fang, Dugan Hammock, and Klee Irwin. Geometric state sum models from quasicrystals. *Foun*dations, 1(2):155–168, 2021.