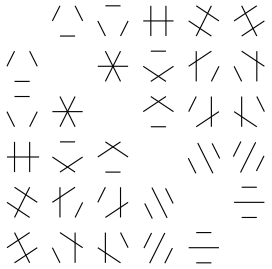
Mathematics Seminar



Rocky Mountain Algebraic Combinatorics Seminar

The Art of Generalized Hilbert Curve Motifs

Douglas McKenna
Mathemaesthetics Inc, Boulder, Colorado

Space-filling curve motifs form visual patterns whose aesthetic freedoms are tempered by unexpected and elegant combinatorial constraints. Accessible to a general audience, this talk concerns those order-n motifs, each a spatially recursive arrangement of n^2 pairwise-adjacent, oriented square tiles, that use Hilbert-style threading. The focus will be on those motifs that under iterated edge-replacement—exponentiation in a monoid—build Hamiltonian (i.e., self-avoiding) tile or dual paths on toroidal or planar grid-graphs.

Exponentiated order-n motifs that fill a square while their edge-based tile paths remain finitely self-avoiding have boundaries governed by one of $F_{(n-3)/2}$ Fibbinary zipper modes, where $n \geq 1$ can only be odd and F_i is the ith Fibonacci number. The zipper mode with the most 0 bits in its Zeckendorf representation freezes over half of the $n \times n$ square tiles into "wedding cake" patterns, essentially emanating constraint at toroidal lattice points.

For motifs built from pairwise edge-adjacent squares, my interactive eBook-app *Hilbert Curves* is a dynamically illustrated compendium of their prototiles and center-connected dual paths. It presents enumerative evidence for full-turn spiral prototiles solving a Hamiltonian path constraint; an infinite sequence of motifs whose curves' fractal tile borders subsume the curves' interior area to converge to fourteen square-filling curves; and new "half-domino" curves, whose almost-everywhere linear, self-similar, and infinitely detailed boundaries are often reminiscent of rug, pottery, basket, or other self-negative, geometric craft designs.

I'll show a few pertinent art pieces, including "A Unit Domino" which won first prize in 2D media in the 2020 Joint Mathematics Meetings art show in Denver.

Spectral Turan problems for intersecting even cycles

Dheer Desai
University of Wyoming

Turán numbers are a cornerstone of extremal graph theory. For graphs with chromatic number at least three, the asymptotics of the Turán numbers are completely known and follow from celebrated results of Erdős, Stone and Simonovits. However, these remain unknown for several basic bipartite graphs. Nikiforov introduced a spectral analogue to these, called spectral Turán problems.

In this talk we will discuss an overview comparing extremal graphs for both kinds of problems and then focus more on some bipartite families. This extends past ideas developed for the spectral even cycle problem and a spectral Erdős-Sós theorem.

Weber 223
4–6 pm, Friday, February 17, 2023
(Refreshments 3:30–4 pm)
Colorado State University
4 pm, Friday, February 17, 2023

This is a joint Denver U / UC Boulder / U of Wyoming / CSU seminar that meets biweekly.
Anyone interested is welcome to join us at a local restaurant for dinner after the talks.

Colorado State University
Department of Mathematics
Fort Collins, Colorado 80523