

PUBLICATION LIST, MELODY CHAN

- **Tropical hyperelliptic curves**, preprint available at [arXiv:1110.0273](https://arxiv.org/abs/1110.0273).

We study the locus of tropical hyperelliptic curves inside the moduli space of tropical curves of genus g . We define a harmonic morphism of metric graphs and prove that a metric graph is hyperelliptic if and only if it admits a harmonic morphism of degree 2 to a metric tree. This generalizes the work of Baker and Norine on combinatorial graphs to the metric case. We then prove that the locus of 2-edge-connected genus g tropical hyperelliptic curves is a $(2g - 1)$ -dimensional stacky polyhedral fan whose maximal cells are in bijection with trees on $g - 1$ vertices with maximum valence 3. Finally, we show that the Berkovich skeleton of a classical hyperelliptic plane curve satisfying a certain tropical smoothness condition lies in a maximal cell of genus g called a standard ladder.

- **Combinatorics of the tropical Torelli map**, to appear in *Algebra and Number Theory*.

This paper is a combinatorial and computational study of the moduli space of tropical curves of genus g , the moduli space of principally polarized tropical abelian varieties, and the tropical Torelli map. These objects were introduced recently by Brannetti, Melo, and Viviani. Here, we give a new definition of the category of stacky fans, of which the aforementioned moduli spaces are objects and the Torelli map is a morphism. We compute the poset of cells of tropical M_g and of the tropical Schottky locus for genus at most 5. We show that tropical A_g is Hausdorff, and we also construct a finite-index cover for A_3 which satisfies a tropical-type balancing condition. Many different combinatorial objects, including regular matroids, positive semidefinite forms, and metric graphs, play a role.

- **Three notions of tropical rank for symmetric matrices**, with D. Cartwright, to appear in *Combinatorica*.

We introduce and study three different notions of tropical rank for symmetric and dissimilarity matrices in terms of minimal decompositions into rank 1 symmetric matrices, star tree matrices, and tree matrices. Our results provide a close study of the tropical secant sets of certain nice tropical varieties, including the tropical Grassmannian. In particular, we determine the dimension of each secant set, the convex hull of the variety, and in most cases, the smallest secant set which is equal to the convex hull.

- **The 4×4 minors of a $5 \times n$ matrix are a tropical basis**, with A. N. Jensen and E. Rubei, *Linear Algebra and its Applications* 435 (2011) 1598-1611.

We compute the space of 5×5 matrices of tropical rank at most 3 and show that it coincides with the space of 5×5 matrices of Kapranov rank at most 3, that is, the space of five labeled coplanar points in \mathbb{TP}^4 . We then prove that the Kapranov rank of every $5 \times n$ matrix equals its tropical rank; equivalently, that the 4×4 minors of a $5 \times n$ matrix of variables form a tropical basis. This answers a question asked by Develin, Santos, and Sturmfels.

- **The distinguishing number of the augmented cube and hypercube powers**, *Discrete Mathematics* 308 (2008), no. 11, 2330–2336.

The distinguishing number of a graph G , denoted $D(G)$, is the minimum number of colors such that there exists a coloring of the vertices of G where no nontrivial graph automorphism is color-preserving. In this paper, we show that the distinguishing number of p -th graph power of the n -dimensional hypercube is 2 whenever $2 < p < n - 1$. This completes the study of the distinguishing number of hypercube powers. We also compute the distinguishing number of the augmented cube, a variant of the hypercube, answering an open question.

- **Improved pebbling bounds**, with A. Godbole, *Discrete Mathematics* 308 (2008), no. 11, 2301–2306.

Consider a configuration of pebbles distributed on the vertices of a connected graph of order n . A pebbling step consists of removing two pebbles from a given vertex and placing one pebble on an adjacent vertex. A distribution of pebbles on a graph is called solvable if it is possible to place a pebble on any given vertex using a sequence of pebbling steps. The pebbling number of a graph, denoted $f(G)$, is the minimal number of pebbles such that every configuration of $f(G)$ pebbles on G is solvable. We derive several general upper bounds on the pebbling number, improving previous results.

- **The distinguishing number of the direct product and wreath product action**, *Journal of Algebraic Combinatorics* 24 (2006), no. 3, 331–345.

Let G be a group acting faithfully on a set X . The distinguishing number of the action of G on X is the smallest number of colors such that there exists a coloring of X where no nontrivial group element induces a color-preserving permutation of X . In this paper, we consider the distinguishing number of two important product actions, the wreath product and the direct product. Given groups G and H acting on sets X and Y respectively, we characterize the distinguishing number of the wreath product of G and H in terms of the number of distinguishing colorings of X with respect to G and the distinguishing number of the action of H on Y . We also prove a recursive formula for the distinguishing number of the action of the Cartesian product of two symmetric groups $S_m \times S_n$ on $[m] \times [n]$.

- **The maximum distinguishing number of a group**, *Electronic Journal of Combinatorics* 13 (2006), no. 1, R70.

Let G be a group acting faithfully on a set X . The distinguishing number of the action of G on X is the smallest number of colors such that there exists a coloring of X where no nontrivial group element induces a color-preserving permutation of X . In this paper, we show that if G is nilpotent of class c or supersolvable of length c then G always acts with distinguishing number at most $c + 1$. We obtain that all metacyclic groups act with distinguishing number at most 3; these include all groups of squarefree order. We also prove that the distinguishing number of the action of the general linear group over a field K on the vector space K^n is 2 if K has at least $n + 1$ elements.

- **Stably computable properties of network graphs**, with D. Angluin, J. Aspnes, M. J. Fischer, H. Jiang, R. Peralta, in *Proceedings of the International Conference on Distributed Computing in Sensor Systems*, Lecture Notes in Computer Science, volume 3560 (2005) 63–74.

We consider a scenario in which anonymous, finite-state sensing devices are deployed in an ad-hoc communication network of arbitrary size and unknown topology, and explore what properties of the network graph can be stably computed by the devices. We show that they can detect whether the network has degree bounded by a constant d , and, if so, organize a computation that achieves asymptotically optimal linear memory use. We define a model of stabilizing inputs to such devices and show that a large class of predicates of the multiset of final input values are stably computable in any weakly-connected network. We also show that nondeterminism in the transition function does not increase the class of stably computable predicates.