Meeting: 1001, Evanston, Illinois, SS 9A, Special Session on Solving Polynomial Systems

1001-12-121 **Christopher J Hillar*** (chillar@math.berkeley.edu), Dept. Mathematics, University of California, Berkeley, Berkeley, CA 94720. *Reconstructing dynamical systems from their zeta functions.*

The m-th cyclic resultant of a polynomial $f \in \mathbb{C}[x]$ is

$$r_m = \operatorname{Res}(f, x^m - 1).$$

We characterize polynomials having the same set of nonzero cyclic resultants. Sequences of the form r_m arise (among many other places) as the cardinalities of sets of periodic points for toral endomorphisms. Let f be monic of degree d with integral coefficients and let $X = \mathbb{T}^d = \mathbb{R}^d/\mathbb{Z}^d$ denote the d-dimensional additive torus. Then, the companion matrix A_f of f acts on X by multiplication mod 1; that is, it defines a map $T : X \to X$ given by

$$T(\mathbf{x}) = A_f \mathbf{x} \bmod \mathbb{Z}^d.$$

Let $\operatorname{Per}_m(T) = \{\mathbf{x} \in \mathbb{T}^d : T^m(\mathbf{x}) = \mathbf{x}\}$ be the set of points fixed under the map T^m. Under the ergodicity condition that no zero of f is a root of unity, it turns out that $|r_m(f)| = |\operatorname{Per}_m(T)|$. We describe how our results allow for reconstruction of such dynamical systems from their zeta functions,

$$Z(T, z) = \exp\left(-\sum_{m=1}^{\infty} |\operatorname{Per}_m(T)| \frac{z^m}{m}\right).$$

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