THE DEPARTMENT OF MATHEMATICAL SCIENCES

Indiana University - Purdue University Fort Wayne

is pleased to present

Peter G. Boyvalenkov

Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

Energy bounds for codes and designs in $H(n,q)$

Abstract

Let $Q=\{0,1,\dots,q-1\}$ be the alphabet of q symbols and $H(n,q)$ be the set of all q-ary vectors $x=(x_1,x_2,\dots,x_n)$ over Q. The Hamming distance $d(x,y)$ between points $x=(x_1,x_2,\dots,x_n)$ and $y=(y_1,y_2,\dots,y_n)$ from $H(n,q)$ is equal to the number of coordinates in which they differ.

We refer to a finite set $C\subset H(n,q)$ as a *code*. For a given function $h(t):[-1,1)\to(0,+\infty)$, we define the *h-energy* (or potential energy) of C by

$$E(n,C;h):=\frac{1}{|C|}\sum_{x,y\in C,x\neq y}h(\langle x,y\rangle).$$

A commonly arising problem is to minimize the potential energy provided the cardinality $|C|$ of C is fixed; that is, to determine $\mathcal{E}(n,M;h):=\min\{E(n,C;h):|C|=M\}$, the minimum possible h-energy of a code $C\subset H(n,q)$ of cardinality M.

Denote also by $\mathcal{F}(n,d;h):=\min\{E(n,C;h):d(C)=d\}$ and by $\mathcal{G}(n,d;h):=\max\{E(n,C;h):d(C)=d\}$ the minimum/maximum possible h-energy of a code $C\subset H(n,q)$ of fixed minimum distance d, and by $\mathcal{L}(n,M,\tau;h):=\min\{E(n,C;h):|C|=M,C\subset H(n,q),C \text{ is } \tau\text{-design}\}$ and $\mathcal{U}(n,M,\tau;h):=\max\{E(n,C;h):|C|=M,C\subset H(n,q),C \text{ is } \tau\text{-design}\}$ the minimum/maximum possible h-energy of τ-designs in $H(n,q)$ of M points.

We apply linear programming techniques for obtaining bounds for the above quantities. Our bounds are universal in the sense they hold for a large class of potential functions and allow unified treatment.

Joint work with: Peter Dragnev, Douglas Hardin, Edward Saff, Maya Stoyanova.

Noon – 1:00, Wednesday, March 4, 2015. Location: KT 216

`http://ipfw.edu/departments/coas/depts/math/news/seminars.html`