John P. McSorley
Department of Mathematics, Southern Illinois University
Carbondale. IL 62901-4408
mcsorley60@hotmail.com

On (n, k, λ)-Ovals and (n, k, λ)-Cyclic Difference Sets, Ladders, Hadamard Ovals and Related Topics

Each fixed integer $n \geq 2$ has associated with it $\lfloor \frac{n}{2} \rfloor$ *rhombs*, $\rho_1, \rho_2, \ldots, \rho_{\lfloor \frac{n}{2} \rfloor}$. Rhomb ρ_h is a parallelogram with smaller face angle equal to $h \times \frac{\pi}{n}$ radians. An *Oval* is an equilateral centro-symmetric convex polygon, each of whose turning angles equals $\ell \times \frac{\pi}{n}$ for some positive integer ℓ. It is tiled by the rhombs $\rho_1, \rho_2, \ldots, \rho_{\lfloor \frac{n}{2} \rfloor}$. An Oval with $2k$ sides is called a '(n, k)-Oval'; it is described by its values of n and k and by its Turning Angle Index Sequence ('TAIS'), a list of the turning angle indices for any consecutive set of k vertices. We are interested in (n, k)-Ovals for which each rhomb is used λ times, we call these magic (n, k, λ)-Ovals. They exist just when a (n, k, λ)-CDS, (cyclic difference set), exists. The above is joint work with Alan Schoen.

A *ladder* is a strip of rhombs which extends from one edge of the Oval to its opposite edge. We classify magic Ovals for which removal of a ladder produces another magic Oval; we call these Hadamard Ovals, they have the parameters of a Hadamard-CDS.

If time permits we will also consider related topics, in particular pseudo-CDS.