Title: Hadamard matrices in centraliser algebras of monomial representations

Abstract:

An n × n matrix H with complex entries of modulus 1 such that H H* = n I_n is a (complex) Hadamard matrix of order n, where H* denotes the complex conjugate transpose of H. When restricted to real entries, it is necessary that either n = 1, 2 or that n is a multiple of 4. It is long conjectured that this condition is sufficient but this is far from settled. Despite this, it appears that the number of (real) Hadamard matrices of order 4m grows exponentially, and classifications even at small orders seem hopeless. This motivates the restriction of our study to matrices with algebraic constructions, such as group development and cocyclic development.

In this talk, we will summarise and extend previous work on monomial group representations and their centraliser algebras. We will locate the theory of group developed and cocyclic Hadamard matrices within the study of such representations. Time permitting, we will apply techniques of computational algebra, e.g., Groebner bases, to search for complex Hadamard matrices in the centraliser of a monomial representation.

(Joint work with Santiago Barrera Acevado, Heiko Dietrich and Padraig Ó Catháin)