

## Morphisms of complex Hadamard matrices

Padraig Ó Catháin, Worcester Polytechnic Institute

Let  $M$  be a matrix with complex entries of unit norm. A well-known theorem of Hadamard bounds the magnitude of the determinant of  $M$  as a function of its dimension, and  $M$  is a complex Hadamard matrix if  $M$  meets Hadamard's bound with equality.

In this talk we will survey some known results on existence of special types of complex Hadamard matrices, in particular matrices with entries in the  $k^{\text{th}}$  roots of unity. I will report on recent joint work with Ronan Egan and Eric Swartz on the existence of tensor-product-like maps which reduce the number of entries in a complex Hadamard matrix at the cost of increasing the dimension. This work generalises previous constructions of Turyn and Compton-Craigen-de Launey of real Hadamard matrices from certain complex Hadamard matrices with entries in the fourth and sixth roots of unity respectively.

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