Contribution ID: 32 Type: Presentation (25 min)

## Matroids and binary functions

Thursday, 22 August 2024 13:30 (25 minutes)

A binary function is a function  $f: 2^E \to \mathbb{C}$  for which  $f(\emptyset) = 1$ , where E is a finite ground set. Binary functions are closely related to quantum registers. They generalise binary matroids in the sense that any indicator function of a linear space over GF(2) is a  $\{0,1\}$ -valued binary function (using the natural correspondence between subsets of E and their characteristic vectors in  $\mathrm{GF}(2)^E$ ); in fact, the author showed in 1993 that every matroid has an associated binary function, although it will not necessarily be just  $\{0,1\}$ -valued.

In a series of papers over 1993-2019, the author generalised some standard matroid transforms and operations —including rank, deletion, contraction, and duality (via the Hadamard transform) —to binary functions, and gave new versions of them that are parameterised by the complex numbers. In each of these settings, a theory of Tutte-Whitney polynomials was developed.

In this talk we review this work and discuss some recent results.

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