APPLIED MATHEMATICS COLLOQUIUM

QUANTUM COMPUTING AND INSTANTANEOUS RADAR POLARIMETRY

ROBERT CALDERBANK
Princeton University

ABSTRACT:

We describe a mathematical framework for detection and estimation that applies to domains as different as remote sensing and quantum information theory.

In remote sensing, the application domain defines one Heisenberg-Weyl group, the signal design domain defines a second group, and the new mathematical framework results from expressing one group in terms of the other. Classical algebraic error correcting codes find new application as phase coded waveforms and the geometry of codewords provides fundamental limits on detection and estimation. Pairs of phase coded waveforms associated with Rudin-Shapiro sequences are shown to enable instantaneous radar polarimetry which provides concurrent and coherent access to all four dimensions of the polarization scattering matrix rather than serial and non-coherent access as is the case today.

In quantum information theory we may view detection and estimation in terms of asking questions of an unknown operator, and it is the symmetries of the probe signal that limit what we can learn through correlation with the return. Our mathematical framework provides a way of focusing questions by choosing the symmetry group of the probe signal appropriately.

MONDAY, NOVEMBER 20, 2006
4:30 PM
Building 2, Room 105

Refreshments at 4:00 PM in Building 4, Room 174
(Math Majors Lounge)

Applied Math Colloquium: http://www-math.mit.edu/amc/fall06
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Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139