

Number theory

Coding on random lattices

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Classical information theory of additive white Gaussian noise channels naturally suggests several coding theoretic problems that can be formulated on lattice theoretic language. For example, performance of a lattice code can be roughly estimated by its Hermite invariant and behavior of the related theta function.

Modern wireless communication channels assume use of multiple antennas and that the transmitted signal gets faded by scattering environment. On such channels classical lattice codes will not perform well. In this talk we will describe how coding in modern fading channels can be seen as coding on random lattice ensembles and how this perspective transforms classical questions into new ones.

In particular we will show how classical Hermite invariant can be replaced by different homogeneous forms and how class field towers with constant root discriminants and non-commutative algebra can be applied in building capacity approaching lattice codes for fading channels.

If time allows we will discuss how averaging transforms theta functions of lattices into sums of different type and how these sums can be analyzed by employing methods from classical algebraic number theory and ergodic theory on Lie groups.

The talk is based on joint work with Laura Luzzi and Francis Lu.