

# The Modulo-Lattice Output is a Sufficient Statistic

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## ABSTRACT

Lattice decoding of a lattice-shaped codebook is a simple alternative for ML decoding, and it is equivalent to ML decoding after modulo-lattice reduction of the channel output. For good (high-dimensional) lattices, this modulo operation is information lossless in the presence of AWGN. At a finite dimension, however, the lattice decoder is inferior to direct ML decoding from the channel output. The "modulo loss" is particularly large at low SNR, and it gets up to 4dB for scalar shaping. We show that for a dirty-paper channel with a strong interference, the modulo output is a **sufficient statistic** for decoding the input. Thus, in this case the modulo loss is, in fact, unavoidable.