



# The Approximate Sum Capacity of the Symmetric Gaussian K-User Interference Channel

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Interference alignment has emerged as a powerful tool in the analysis of multi-user networks. Despite considerable recent progress, the capacity region of the Gaussian K-user interference channel is still unknown in general, in part due to the challenges associated with alignment on the signal scale using lattice codes. This paper develops a new framework for lattice interference alignment, based on the compute-and-forward approach. Within this framework, each receiver decodes by first recovering two or more linear combinations of the transmitted codewords with integer-valued coefficients and then solving these equations for its desired codeword. For the special case of symmetric channel gains, this framework is used to derive the approximate sum capacity of the Gaussian interference channel, up to an explicitly defined outage set of the channel gains. The key contributions are the capacity lower bounds for the weak through strong interference regimes, where each receiver should jointly decode its own codeword along with part of the interfering codewords. As part of the analysis, it is shown that decoding K linear combinations of the codewords can approach the sum capacity of the K-user Gaussian multiple-access channel up to a gap of no more than  $K \log(K)/2$  bits.

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