On the Corner Points of the Capacity Region of a Two-User Gaussian Interference Channel

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ABSTRACT

This work considers the corner points of the capacity region of a two-user Gaussian interference channel (GIC). In a two-user GIC, the rate pairs where one user transmits its data at the single-user capacity (without interference), and the other at the largest rate for which reliable communication is still possible are called corner points. This work relies on existing outer bounds on the capacity region of a two-user GIC that are used to derive informative bounds on the corner points of the capacity region. The new bounds refer to a weak two-user GIC (i.e., when both cross-link gains in standard form are positive and below 1), and a refinement of these bounds is obtained for the case where the transmission rate of one user is within $\varepsilon > 0$ of the single-user capacity. The bounds on the corner points are asymptotically tight as the transmitted powers tend to infinity, and they are also useful for the case of moderate SNR and INR. Upper and lower bounds on the gap (denoted by Δ) between the sum-rate and the maximal achievable total rate at the two corner points are derived. This is followed by an asymptotic analysis analogous to the study of the generalized degrees of freedom (where the SNR and INR scalings are coupled such that $\frac{\log(\text{INR})}{\log(\text{SNR})} = \alpha \geq 0$), leading to an asymptotic characterization of this gap which is exact for the whole range of α. The upper and lower bounds on Δ are asymptotically tight in the sense that they achieve the exact asymptotic characterization. Improved bounds on Δ are derived for finite SNR and INR, and their improved tightness is exemplified numerically. This talk presents in part the paper that is available at `http://arxiv.org/abs/1306.4934`