

# An Improved Achievable Region for the Discrete Memoryless Two-User Multiple-Access Channel with Noiseless Feedback.

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## Abstract

An achievable region for the two-user discrete memoryless multiple-access channel with noiseless feedback is proposed. The proposed region includes the Cover-Leung region [2], with the inclusion being, for some channels, strict. This inner bound is demonstrated for the ideal two-user Poisson multiple-access channel with noiseless feedback, in which case it is shown to improve on the Cover-Leung rate-sum.

*Index Terms* – Two-user DMMAC with noiseless feedback, feedback capacity, Ideal Poisson MAC, optical CDMA.

## I. Introduction

No single-letter expression for the capacity region of a general discrete memoryless multiple access channel (MAC) with feedback is known. The observation that this region can be strictly larger than the capacity region of the MAC without feedback is due to Gaarder and Wolf [1]. Cover and Leung established an inner bound to the capacity region for the MAC with feedback in [2]. However, as demonstrated by Ozarow [7], this inner bound is not always tight. Nevertheless, Willems has shown [4] that the Cover-Leung inner bound is tight if the channel satisfies the condition that at least one of the encoders can determine the symbol produced by the other encoder based on the channel output and the symbol it produced itself. Willems's condition was subsequently somewhat weakened by Hekstra and Willems [5].

Recently, Kramer [8, 9] used the notion of *directed information* to derive an expression for the capacity region of the MAC with feedback. This expression, however, is an incomputable non single-letter expression.

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