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Optimising entanglement distillation[1] FILIP ROZPEDEK, THOMAS SCHIET, LE P. THINH, DAVID ELKOUSS, QuTech, Delft University of Technology, ANDREW C. DOHERTY, Centre for Engineered Quantum Systems, School of Physics, The University of Sydney, STEPHANIE WEHNER, QuTech, Delft University of Technology — Entanglement distillation is of great importance in many quantum information processing tasks. It allows to convert multiple copies of a noisy entangled state into a smaller number of less noisy entangled states using only local operations and classical communication. Here we investigate the fundamental trade-off between the output fidelity to a maximally entangled state and the probability of success in probabilistic distillation protocols. Due to this trade-off, it has been an open question to find the most efficient protocol. In this work we develop a framework for demonstrating optimality of well-known protocols for specific input states. Using tools of semi-definite programming we obtain upper bounds on the output fidelity for a specific input state and a fixed probability of success. Specifically, we develop a semi-definite programme that optimises the output fidelity over the positive partial transpose operations. We then apply our programme to various states that naturally arise in experimental scenarios. For specific states our bounds are achievable with the DEJMPS (PRL, vol, 77, no. 13 p. 2818, 1996) or the EPL (PRX, vol 4, Iss 12, p. 041041, 2014) protocol, hence demonstrating the optimality of these protocols for those states.

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