# Renormalization of quantum information measures: an approach to quantum criticality

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A quantum renormalization group (QRG) – based on the Kadanoff block RG – to investigate the quantum information aspects is introduced. This method provides a powerful alternative approach to studying quantum information properties of various quantum spin models. We elaborate the idea through two examples. In particular, the evolution and finite-size scaling of entanglement (concurrence) and its derivative close to the quantum critical point of the Ising model in transverse magnetic field (ITF) is investigated. We obtain that the derivative of concurrence of two blocks, each comprised of half of the system, diverges at the critical point with an exponent directly associated to the divergence of the correlation length. Moreover, we calculate the quantum fidelity susceptibility for the ITF model, and find its scaling behavior in the vicinity of the quantum criticality. Next, the QRG is applied to the anisotropic Heisenberg model (XXZ). Here our scheme demonstrates how the minimum value of the first derivative of concurrence scales with the system size. We also study the effect of a Dzyaloshinskii-Moriya interaction on the quantum information properties of the ITF and XXZ models near their quantum critical boundaries. Our method is inherently fairly general and can hopefully shed more light on properties of a wide spectrum of quantum critical systems.