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Fluctuation relations and information thermodynamics: towards applications in interacting particle systems

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The inclusion of feedback mechanisms in nonequilibrium processes has led to the generalisation of equalities known as the nonequilibrium work relations and the development of information thermodynamics. This has allowed study of the relationship between information and entropy production, including the concept of information-heat engines which allow information to be transformed into useful work and vice versa. We explore different forms of fluctuation relationships with feedback, testing them analytically and numerically for simple random walk models. We further consider the application of these ideas to more complex interacting particle models.