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Sommario/riassunto	This thesis presents a revolutionary technique for modelling the dynamics of a quantum system that is strongly coupled to its immediate environment. This is a challenging but timely problem. In particular it is relevant for modelling decoherence in devices such as quantum information processors, and how quantum information moves between spatially separated parts of a quantum system. The key feature of this work is a novel way to represent the dynamics of general open quantum systems as tensor networks, a result which has connections with the Feynman operator calculus and process tensor approaches to quantum mechanics. The tensor network methodology developed here has proven to be extremely powerful: For many situations it may be the most efficient way of calculating open quantum dynamics. This work is abounds with new ideas and invention, and is

likely to have a very significant impact on future generations of physicists.