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Autore	Ran Shi-Ju
Titolo	Tensor Network Contractions [[electronic resource]] : Methods and Applications to Quantum Many-Body Systems / / by Shi-Ju Ran, Emanuele Tirrito, Cheng Peng, Xi Chen, Luca Tagliacozzo, Gang Su, Maciej Lewenstein
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Disciplina	530.15
Soggetti	Physics Quantum physics Quantum optics Statistical physics Machine learning Elementary particles (Physics) Quantum field theory Mathematical Methods in Physics Quantum Physics Quantum Optics Statistical Physics and Dynamical Systems Machine Learning Elementary Particles, Quantum Field Theory
Lingua di pubblicazione	Inglese
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Nota di contenuto	Introduction -- Tensor Network: Basic Definitions and Properties -- Two-Dimensional Tensor Networks and Contraction Algorithms -- Tensor Network Approaches for Higher-Dimensional Quantum Lattice Models -- Tensor Network Contraction and Multi-Linear Algebra -- Quantum Entanglement Simulation Inspired by Tensor Network -- Summary.

Tensor network is a fundamental mathematical tool with a huge range of applications in physics, such as condensed matter physics, statistic physics, high energy physics, and quantum information sciences. This open access book aims to explain the tensor network contraction approaches in a systematic way, from the basic definitions to the important applications. This book is also useful to those who apply tensor networks in areas beyond physics, such as machine learning and the big-data analysis. Tensor network originates from the numerical renormalization group approach proposed by K. G. Wilson in 1975. Through a rapid development in the last two decades, tensor network has become a powerful numerical tool that can efficiently simulate a wide range of scientific problems, with particular success in quantum many-body physics. Varieties of tensor network algorithms have been proposed for different problems. However, the connections among different algorithms are not well discussed or reviewed. To fill this gap, this book explains the fundamental concepts and basic ideas that connect and/or unify different strategies of the tensor network contraction algorithms. In addition, some of the recent progresses in dealing with tensor decomposition techniques and quantum simulations are also represented in this book to help the readers to better understand tensor network. This open access book is intended for graduated students, but can also be used as a professional book for researchers in the related fields. To understand most of the contents in the book, only basic knowledge of quantum mechanics and linear algebra is required. In order to fully understand some advanced parts, the reader will need to be familiar with notion of condensed matter physics and quantum information, that however are not necessary to understand the main parts of the book. This book is a good source for non-specialists on quantum physics to understand tensor network algorithms and the related mathematics.
