Review Article

Iranian Journal of Physics Research, Vol. 26, No. 1, 2026
DOI: 10.47176/ijpr.26.1.12229

Optimization by classical and quantum reinforced algorithms

Abolfazl Ramezanpour*

Department of Physics, College of Science, Shiraz University, Shiraz 71454, Iran

E-mail: aramezanpour@gmail.com

(Received 24 November 2025 ; in final form 06 December 2025)

Abstract

A wide range of fundamental problems in science—including the determination of equilibrium states in physical systems and the training and analysis of neural networks—can be cast as optimization problems. However, the intrinsic complexity of these systems, particularly near critical points and phase transitions, often renders the computation of even approximate solutions highly demanding. Methods originating from statistical physics, especially those developed for the study of disordered and complex systems, have contributed significantly to the development of more efficient computational strategies for such tasks. In this review, we review key concepts and algorithmic approaches inspired by classical and quantum statistical mechanics, with an emphasis on recent theoretical developments and practical applications. Particular attention is devoted to reinforcement-based optimization methods and their role in improving solution quality, as well as the implications of reinforcement mechanisms for noise mitigation in quantum systems. We conclude by outlining several open challenges and promising directions for future research.

Keywords: Optimization, Algorithms, Reinforcement

For full article, refer to the Persian section