An LQR-Lagrange Algorithm Generated by Interdisciplinary Integration with Optimal Control and Optimization

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Abstract

Interdisciplinary integration is a superior method to improve the optimization algorithm. In this paper, control theory and optimization are combined, and the optimization algorithm is regarded as a control process. Based on the premise of optimal control, the state equation corresponding to Lagrange Algorithm is established with the Karush-Kuhn-Tucker (KKT) conditions as the objective. As an optimal control method, Linear Quadratic Regulator (LQR) is utilized to control the calculation process, and an innovative LQR-Lagrange Algorithm is proposed. The Lyapunov stability criterion is applied to analyze the convergence, and it is proved that the proposed LQR-Lagrange Algorithm is bound to converge as long as the parameter matrices and are positive definite. The analysis indicates that the influence of parameters in LQR-Lagrange Algorithm on the calculation speed is monotonic, and the elements in and has no effect on the convergence. Therefore, the proposed algorithm has a monotonic and user-friendly parameter tuning strategy. The significance and advantages of interdisciplinary integration with control theory and optimization are discussed in the end.

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