Abstract

The paper presents using Differential Evolution (DE) and Shuffled Frog Leaping Algorithm (SFLA) to optimally tune parameters of a fuzzy logic controller stabilizing a rotary inverted pendulum system at its upright equilibrium position. Both the DE and SFLA are meta-heuristic search methods. DE belongs to the class of evolutionary algorithms while SFLA is inspired from the memetic evolution of a group of frogs when seeking for food. In this study, the rule base of the Fuzzy Logic Controller (FLC) is brought by expert experience, and the parameters of the controller, i.e. the membership function parameters and scaling gains, are optimally tuned by the DE and SFLA such that a predefined criterion is minimized. Simulation results show that the designed fuzzy controller is able to balance the rotary inverted pendulum system around its equilibrium state. Besides, convergent rate of SFLA is faster than that of DE but DE has ability to find optimal solutions better than SFLA does.
8. Quanser.: SRV02-Series Rotary Experiment # 7, “Rotary Inverted Pendulum”.


Index Terms

Computer Science  Fuzzy Systems

Keywords

Optimization, DE, SFLA, Fuzzy Controller