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长论文

具有适应性突变和惯性权重的粒子群优化(PSO)算法及其在动态系统参数估计中的应用

ALFI Alireza

Faculty of Electrical and Robotic Engineering, Shahrood 36199-95161, Iran

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摘要

An important problem in engineering is the unknown parameters estimation in nonlinear systems. In this paper, a novel adaptive particle swarm optimization (APSO) method is proposed to solve this problem. This work considers two new aspects, namely an adaptive mutation mechanism and a dynamic inertia weight into the conventional particle swarm optimization (PSO) method. These mechanisms are employed to enhance global search ability and to increase accuracy. First, three well-known benchmark functions namely Griewank, Rosenbrock and Rastrigrin are utilized to test the ability of a search algorithm for identifying the global optimum. The performance of the proposed APSO is compared with advanced algorithms such as a nonlinearly decreasing weight PSO (NDWPSO) and a real-coded genetic algorithm (GA), in terms of parameter accuracy and convergence speed. It is confirmed that the proposed APSO is more successful than other aforementioned algorithms. Finally, the feasibility of this algorithm is demonstrated through estimating the parameters of two kinds of highly nonlinear systems as the case studies.

关键词 Particle swarm optimization (PSO) parameter estimation nonlinear dynamics inertia weight adaptive mutation

分类号

PSO with Adaptive Mutation and Inertia Weight and Its Application in Parameter Estimation of Dynamic Systems

ALFI Alireza

Faculty of Electrical and Robotic Engineering, Shahrood 36199-95161, Iran

Abstract

An important problem in engineering is the unknown parameters estimation in nonlinear systems. In this paper, a novel adaptive particle swarm optimization (APSO) method is proposed to solve this problem. This work considers two new aspects, namely an adaptive mutation mechanism and a dynamic inertia weight into the conventional particle swarm optimization (PSO) method. These mechanisms are employed to enhance global search ability and to increase accuracy. First, three well-known benchmark functions namely Griewank, Rosenbrock and Rastrigrin are utilized to test the ability of a search algorithm for identifying the global optimum. The performance of the proposed APSO is compared with advanced algorithms such as a nonlinearly decreasing weight PSO (NDWPSO) and a real-coded genetic algorithm (GA), in terms of parameter accuracy and convergence speed. It is confirmed that the proposed APSO is more successful than other aforementioned algorithms. Finally, the feasibility of this algorithm is demonstrated through estimating the parameters of two kinds of highly nonlinear systems as the case studies.

Key words Particle swarm optimization (PSO) parameter estimation nonlinear dynamics inertia weight adaptive mutation

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通讯作者

作者个人主页 ALFI Alireza