

基于 IGWO 算法优化的 SVM 模拟电路故障诊断

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摘要: 为提高基于支持向量机 (SVM) 模拟电路故障诊断的准确率和优化效率, 在灰狼优化 (GWO) 算法的基础上, 通过引入非线性收敛因子、动态权重和边界变异策略, 提出了一种改进灰狼优化 (IGWO) 算法优化 SVM 参数 (IGWO-SVM) 的改进型分类器。首先, 在 Sallen-Key 带通滤波器和四运放双二次高通滤波器电路中采集故障样本, 并对故障样本进行小波包特征提取; 然后, 将特征提取后的样本划分为训练样本和测试样本, 利用 IGWO 算法来优化 SVM 中的惩罚参数 C 和核参数 γ, 得到最优的 SVM 分类器模型; 最后, 与其他算法优化的 SVM 分类器进行对比, 结果表明 IGWO-SVM 分类器可以防止种群陷入局部最优, 同时收敛速度有了较大提升。

关键词: 改进灰狼优化算法; 支持向量机; 模拟电路; 故障诊断

Analogue Circuit Fault Diagnosis Based on SVM

Optimized by IGWO

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Abstract: In order to improve the accuracy and optimization efficiency of analog circuit fault diagnosis based on support vector machine (SVM), on the basis of gray wolf optimization (GWO) algorithm, this paper proposes a modified classifier that uses the improved gray wolf optimization (IGWO) algorithm to optimize the parameter of SVM (IGSA-SVM) by introducing the nonlinear convergence factor, dynamic weight and boundary variation strategy. Firstly, the fault samples are collected in the Sallen-Key bandpass filter circuit and four opamp biquad highpass filter circuit, and wavelet packet feature extraction is applied to fault samples. Then, feature-extracted samples are divided into training samples and test samples. The IGWO algorithm is used to optimize the penalty parameter C and the kernel parameters γ in SVM to obtain the optimal SVM classifier model. Finally, compared with SVM classifiers optimized by other algorithms, the results show that the IGWO-SVM classifier can prevent the population from falling into a local optimum, and the convergence speed has been greatly improved.

Key words: improved gray wolf optimization algorithm; support vector machine; analog circuit; fault diagnosis

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