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细菌群趋药性算法在电气设备缺陷参数红外识别中的应用

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摘要： 将电气设备零件缺陷参数的红外定量识别视为某种形式的结构设计优化问题，引入细菌群趋药性优化算法和径向基函数神经网络，搭建了一个简单而完整、通用灵活的多学科设计优化框架对该问题进行求解。其中径向基函数神经网络作为代理模型，精度较高、计算速度较快，可简化复杂、费时的有限元计算以得到不同缺陷参数条件下零件表面的温度场；将该温度场与目标温度场之间的差异作为目标函数，以细菌群趋药性优化算法进行缺陷参数的定量识别。该方法在一个简单的三维夹杂型缺陷参数的红外识别算例中取得了满意的结果，与粒子群优化算法相比，可以更快地接近优化解。

关键词： 细菌群趋药性算法 缺陷 识别 红外 传热反问题 多学科设计优化

Application of Bacterial Colony Chemotaxis Optimization Algorithm in Infrared Identification of Parameters of Defect in Electric Apparatus

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Abstract: The quantitative infrared identification of parameters of defect in electric apparatus using the surface temperature profile was considered as a structure design optimization problem. A bacterial colony chemotaxis (BCC) optimization algorithm and a radial basis function neural network (RBFNN) were introduced into solving this problem, then a simple but complete multidisciplinary design optimization framework was constructed for the sake of generality and flexibility. The RBFNN was a precise and convenient surrogate model for the time costly finite element computation, and the difference between the obtained the surface temperature with different defect parameters and the target surface temperature profile was the objective function of the BCC optimization algorithm. This method was applied to a simple verification case and the result is quite acceptable. The BCC algorithm was also compared with the particle swarm optimization algorithm, and the results show that the former can access the optimum with faster speed.

Keywords: bacterial colony chemotaxis algorithm defect identification infrared inverse heat transfer problem multidisciplinary design optimization

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