

内置式电容层析成像系统传感器优化设计

作者: 郭志恒 邵富群 律德才

单位: 1. 东北大学信息科学与工程技术学院, 沈阳110004; 2. 辽宁科技学院自动化系, 辽宁本溪117022

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摘要:

电容层析成像系统重建图像的质量主要依赖于系统的观测矩阵, 即灵敏度矩阵, 灵敏度矩阵的特性又由传感器的结构参数所决定的。本文提出了采用反映灵敏度矩阵特性的条件数作为主要的电容传感器优化设计指标, 结合表示传感器电极总体灵敏程度的电容变化量指标, 兼顾最大、最小电容测量值满足测量范围的要求进行综合优化设计。通过有限元方法, 分析了内置式传感器电极结构参数对电容测量值和灵敏度矩阵的影响, 并利用综合指标进行了优化, 获得了一组内置式传感器优化结构参数。

关键词: 电容层析成像; 内置式电容传感器; 参数优化设计

Optimum Design of Interior Electrode Sensors for ECT System

Author's Name: GUO Zhi-heng¹, SHAO Fu-qun LV Decai

Institution: 1. School of Information Science and Engineering, Northeastern University, Shenyang 110004, China; 2. Department of Automation, Liaoning Institute of Science and Technology, Benxi Liaoning 117022, China

Abstract:

In electrical capacitance tomography (ECT) system, the reconstructed image quality greatly depends on the system observation matrix, that is sensitivity matrix, and its characteristic lies on the structure parameters of the sensor. In this paper, it is proposed that the condition number representing the sensitivity matrix characteristic is acted as a main optimum criteria, and the criteria, combining the detected capacitance change and adapting to measure scope, is used to perform synthetical optimization for the sensor design. By finite element method, we discuss the effect of the structure parameters of the sensor on measurement and reconstruction for ECT and make optimization of the sensor design, finally obtain a set of optimum parameters for the interior-electrode sensor design.

Keywords: Electrical Capacitance Tomography; Interior capacitance sensor; parameter optimization

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