

## 基于单电极双模态数字化系统设计

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摘要:

由于电阻层析成像(ERT)和电容层析成像(ECT)具有不同的应用范围, 为了拓宽测量范围, 通常采用ECT和ERT阵列电极组合形成双模态结构。作者在传统ECT传感器研究基础上, 提出了一种新颖的单电极双模态传感器结构, 并有效消除了两模态的相互影响, 实现单模态或双模态运行。本文设计的数字化系统, 充分利用FPGA和DSP, 实现了全数字正交序列解调, 系统的速度和精度都得到了提高。对系统中单电极双模态传感器、激励信号发生模块、电阻/电容转换电路及相敏解调单元等进行了分析。实验表明, 该系统工作稳定、使用灵活, 明显拓展测量范围。

关键词: 单电极双模态; 电阻/电容转换; 数字解调; 重建图像

## A Digitized Dual-Modal System Based on Single Electrode

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**Abstract:**

Electrical resistance tomography(ERT) and electrical capacitance tomography(ECT) have different fields of application. In order to expand the measurement range, combining the both ECT and ERT array electrode modalities to form dual-modal structure is generally used. This paper presents a novel single electrode dual-modal sensor based on the study of traditional ECT sensor. It can eliminate the interaction between two sensitive fields effectively and can operate in either single ECT/ERT modality or dual-modality. A digital system is designed in this paper which makes full use of FPGA and DSP, and realizes the full digital quadrature demodulation. Both the systematic speed and precision are improved. Several Key modules in system, including the single electrode dual-modal sensor, excitation signal source module, resistor and capacitor switching circuit and phase sensitive demodulation are analyzed in this paper. Simulation and experiments show that the system can operate stably, flexibly, and expand the measurement range.

**Keywords:** single electrode dual-modal;resistance/capacitance conversion;digital demodulation;image reconstruction

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