

摘要: 针对电容层析成像技术(ECT)的图像重建质量精度较低的问题,提出了一种基于粒子滤波的ECT图像重建方法。首先,分析了ECT建基本原理,以系统状态估计的方式描述了ECT图像重建最优解的搜索过程,并建立了状态空间模型。然后,以线性反投影(LBP)算法的结果作为初始状态,利用测量信息对从状态空间中获取的随机样本进行最优加权,以获得重建图像的最小方差估计。最后,对5种不同的仿真实验。实验结果表明,利用本文方法获得的重建图像误差平均值为42.93%,相关系数平均值为0.813 9,比LBP算法、Landweber法和IMNSNOF算法得到的相应指标要好。本文方法是一种有效、精度较高的ECT图像重建方法,为ECT图像重建技术提供了新的途径

关键词: 电容层析成像 粒子滤波 图像重建 图像误差 相关系数

## Application of particle filtering algorithm to image reconstruction of ECT

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Abstract: For the low accuracy of image reconstruction in Electrical Capacitance Tomography (ECT), a image reconstruction method for the ECT was proposed based on the particle filter algorithm. Firstly, the principle of image reconstruction of the ECT was analyzed. Then, the search process of the optimal solution for image reconstruction of the ECT was described as a system state estimation process, and a state space model was established. Further to obtain the minimum variance estimation of image reconstruction, the image reconstruction result of Linear Back Projection (LBP) algorithm was taken as the initial state, and the optimal weights of random samples obtained from the state space were calculated by the measured information. Finally, the simulation experiments with five different flow regimes were performed. The experiment results show that the average image error of reconstruction with the proposed method is 42.93%, and the average correlation coefficient with the original image is 0.813 9, which is better than corresponding indicators obtained by LBP algorithm, Landweber iterative algorithm and IMNSNOF algorithm. In conclusion, the image reconstruction method with high efficiency and accuracy can provide a new way for ECT research.

Keywords: electrical capacitance tomography particle filter image reconstruction image error correlation coefficient

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