基于光耦探测器显微**CT**的实现及其放大倍数的标定

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摘　要：

X射线显微CT因其较高的成像分辨率，被应用于微小样品内部精细结构的检测。分辨率是显微CT最受关注的指标之一，而实现其测量功能则是当今CT研究领域的前沿方向。为了提高分辨率，本文设计实现了一种基于光耦探测器的显微CT系统，对经过几何放大的图像再进行光学放大。由于对其放大倍数的准确标定是实现其测量功能的重要前提，研究提出了基于标准栅格板和标准球的标定方法，对基于光耦探测器的显微CT的光学放大倍数和几何放大倍数分别进行了标定。这样即使在实际测试中射线源、样品和探测器的位置发生改变，亦可直接算出总放大倍数。标定过程还使用了最小二乘法以提高标定精度。二维X射线投影图像测量实验和三维重建结果测量实验显示，此种放大倍数标定方法是准确、有效的。

关键词：显微CT；光耦探测器；放大倍数标定；无损检测

Realization of micro-CT based on a lens-coupled detector and calibration of its magnification

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Abstract:

X-ray computerized microtomography (micro-CT) is used to test tiny structures due to its high image resolution. Image resolution is one of its most important characteristics, and actualizing its measuring function is the cutting edge of CT research. To enhance its resolution, a micro-CT based on a lens-coupled detector was designed and actualized, which magnified samples optically besides geometric magnification. Since calibrating its magnification accurately is a premise to realize measurement with it, a calibration method using a grid pattern and a standard ball was proposed, which calibrated the optical magnification and the geometrical magnification respectively. Even if positions of the X-ray source, the sample and the detector are changed in later measurements, the total magnification can also be calculated. To increase calibrating precision, least square method was involved. Measurement experiments on 2D projection images and a 3D reconstruction result show that the calibration method is precise and valid.

Keywords: micro-CT; lens-coupled detector; magnification calibration; non-destructive testing

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