

### 基于图像的小尺寸零件圆参数亚像素定位算法

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#### 摘要

亚像素软件处理技术可以在一定程度上补偿图像测量系统由硬件限制引起的边缘定位误差, 针对工业中的小尺寸圆形零件参数检测, 提出了一种基于Zernike矩、二次多项式插值和最小二乘法拟合的圆参数亚像素定位算法。首先根据Zernike正交复数矩建立圆物体边缘点与边缘参数之间的映射关系, 并提取边缘点; 然后利用二次多项式插值在梯度方向上对提取出的边缘点进行进一步定位; 最后利用最小二乘法拟合插值后的边缘点, 得到亚像素精度的圆参数。通过小尺寸圆形惯性器件图像边缘提取实验, 对该算法的有效性和检测精度进行了研究, 给出了惯性器件的实测尺寸对比结果。实验结果表明: 提出的圆参数亚像素定位算法比传统算子具有更高的检测定位精度, 可满足图像目标高精度实时在线测量的要求。

关键词 [计算机应用](#) [Zernike矩](#) [正交圆算子](#) [亚像素边缘定位](#) [惯性器件](#) [二次多项式插植](#) [圆参数检测](#)

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### Subpixel localization algorithm of circle parameters based on still image of small parts

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**Abstract** Subpixel algorithm is an effective method to improve the error of edge location under assured hardware condition. Aiming at the circle parameters detection of small size parts in industry, a novel algorithm for subpixel location of circle parameters was proposed based on Zernike moments, quadratic polynomial interpolation and least squares method. First, orthogonal circle operator was modeled in terms of Zernike orthogonal complex moment; the one-to-one mapping between the edge point and the parameters of the circle was established by the algorithm. Then, quadratic polynomial interpolation was adopted to further locate the edge points in the gradient direction. Finally, the subpixel-level circle parameters can be obtained by fitting the edge points using least-square method. Experiments were conducted on small circular inertial device to validate the algorithm and to study its detecting precision. Results show that the detecting precision is higher than traditional operators and the algorithm is very effective in detecting subpixel level circle edges for real time online measurement.

**Key words** [computer application](#) [Zernike moments](#) [orthogonal circle operator](#) [subpixel edge detection](#) [inertial device](#) [quadratic polynomial interpolation](#) [circle parameters detection](#)

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