



Preface

At present, in machining processes for machine parts, loading of workpieces into the machine tools, transfer between processes, and other workpiece transfer operations between machining processes are often still dependent on manual labor. If this mechanical parts picking

1 Development issues and solutions

(1) Development issues

In ordinary picking operations, the method for recognizing workpiece positions and postures involves the use of cameras trained on workpieces laid out on a conveyor or other flat surfaces to perform 2D grayscale image processing. However, this method is limited in the range of picking automation applications, in that it requires

based on a range image captured with the 3D vision sensor, enabling calculation of the 3D positioning and posture. In addition, we eliminated the need for a template image model used in normal image recognition processes, enabling recognition of diverse workpiece postures.

The bulk workpiece recognition procedure is as shown below.

Edge detection and partitioning process

The edges of each workpiece are detected from the range image, and region partitioning process is performed. An external view of forged material workpieces is shown in Fig. 4(a), and an image after region partitioning process is shown in Fig. 4(b).

Feature quantity calculation

After the region partitioning process, labeling is performed for each sub-region, and feature quantities are calculated for the height, area center, surface curvature, and area, etc., of each extracted sub-region.

Detection of workpiece targeted for gripping

The workpiece targeted for gripping is determined from the sub-region extracted using the region partitioning process, and the 3D coordinates of the gripping position, and the workpiece tilt and rotation angles are

calculated. The range image, and detection results for a workpiece targeted for gripping, are shown in Fig. 4(c).

(3) Online interference simulator

In previous bin-picking robot systems, when the robot approached the workpiece targeted for gripping, it would occasionally collide with workpieces surrounding the target workpiece or with the container box, causing the system to stop. To solve this problem and enable stable picking operations, we applied the interference check function of the Kawasaki robot simulator to develop an online ...



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