Use of Industrial Robots to Increase Productivity of Peening Operation

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ABSTRACT

The purpose of this paper is to discuss the various ways industrial robots can be applied to increase the productivity of peening operations. In addition t an increase in productivity an increase in accuracy and repeatability can be achieved by proper application of industrial robots.

KEYWORDS

Repeatability, Process Control, Robot Protection

INTRODUCTION

Shot peening is analogous to machining operations in that it is an operation that must be performed to many critical workpieces. The accuracy requirements inherent in a machining operation are generally not required in a peening application, but other problems are encountered; such as contamination of intricate mechanisms and impingement of peening media on machine components.

ROBOT LOAD/UNLOAD

The first and most readily adaptable method of applying a robot to a peening process is to simply have the robot load and unload a conventional or nearly conventional peening machine. This offers advantages in that it can be retrofitted to existing processes and the robot can be effectively protected from the peening media. This is especially attractive where heavy or cumbersome workpieces are involved and operator fatigue may represent a problem. Workpieces must be presented to the peening station in batches and oriented properly for the robot to grasp them. Several disadvantages of this approach are inherent. The robot is being utilized only during the load/unload cycle and this application of a robot does not increase the accuracy of the peening process. If the workpiece must be turned over as a part of the process the application may require an intermediate holding station to allow interfacing with a robot.

ROBOT MANIPULATION OF WORKPIECE

A second method of applying a robot to a peening process is to have the robot manipulate the workpiece in the stream of peening media. This offers several advantages over the first approach. The capabilities of the robot system are more effectively utilized and the robot can be used as an integral part of controlling the peening process. Variables such as impact angle, exposure time, and distance from media source can be programmed into the robot control and repeatability of the process is enhanced. Small workpieces requiring precise peening on surfaces at various angles would be candidates for this application. Large parts requiring peening all over and parts larger than the robot's reach would probably not be good choices. Again, the workpieces would have to be oriented in batches to interface with the robot. The major problem encountered with this method is adequately protecting the robot and gripper from the peening media.

By having the robot hold the part, the media stream is now directed at the robot wrist and gripper so it must not only be protected from a dusty environment, but also from direct impingement of media. These problems are not insurmountable, but they represent a real challenge to the designer.

ROBOT MANIPULATION OF MEDIA SOURCE

The third approach which overcomes many of the inherent problems of the preceding applications is to have the robot hold and articulate the source of the peening media whether it be an air nozzle or a centrifugal wheel. This allows the robot program to control the peening process variables of time, distance, and angle, and takes the robot mechanism out of the direct impingement of abrasive media. In the case of an air nozzle, a relatively small robot can handle the job even when applied to a large workpiece and the workpiece could be fixtured to allow turnover or repositioning. Robot gripper design problems are no longer inherent since the device is affixed permanently to the robot, thus there is less mechanism to protect from the peening media. This approach could be used in conjunction with a robot load/unload mechanism, eliminating operator fatigue as well as improving the accuracy and repeatability of the peening process.

ROBOT MANIPULATION OF MEDIA SOURCE -- continued

The advantages of a robotic interface to a peening process include such widely publicized benefits such as "robots don't take coffee breaks, sick leave, vacations, get tired, etc., etc." As peening processes become more automated, additional measures must be taken to insure control of the process. Shot flow monitors, error detection systems, and programmed report generation will be necessary to monitor an automated peening cell, and insure that each workpiece receives the required peening.

Vision systems will most certainly be among future trends in automated peening. This will allow more indiscriminate positioning of workpieces and could conceivably be used to check peening coverage of critical areas of workpieces.

Future applications of robots for the peening process are limited only by the imagination of the designer. Each new workpiece configuration and peening requirement may be addressed by one or a combination of the methods described.

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