THE MONITORING OF AUTONOMOUS THREADED FASTENING USING LEAST SQUARE BASE ON FIVE PARAMETERS

Mongkorn Klingajay and N.I. Giannocaro

Abstract

The principle of the thread fastenings have been known and used for decades. Its long applications become to a common manufacturing with the purpose of joining one component to another. Threaded fastenings are typically with purposes of joining one component to another. It is carried out manually since being a difficult problem to automate. The thread fastenings are a common assembly method that have been accounting for over a quarter of all assembly operations. This operation is widely used and popularly applied, because it is permitted easy to disassembly, reassembly, and relocation for maintenance, repairing. There is very little research on automating threaded fastenings, and most research on automated assembly focus on the peg-in-hole assembly problem. Screw insertions are typically carried out manually with same purposes of threaded fastening in joining one and another component. The screw insertion task is more complex than peg-in-hole insertion, and hence has received relatively little research attention.

This paper is proposed on various strategies for the monitoring of the screw insertion process. The approach adopted in this study is to use an analytical model developed by the authors to predict ideal insertion signals. However, this model requires various fixed process parameters as input, and it is not always possible to know these parameters in advance with sufficient accuracy. Hence the focus of this paper is the on-line parameter estimation during threaded assembly. The noise reduction techniques such as noise filter and curve fitting are also included in this study to achieve the corrected signal during monitoring. A monitoring methodology for estimating five unknown parameters of a general self-tapping screw insertion is presented. The approach is based on the Least Square Method (LSM). It is shown that the five estimated parameters required by the model can be reliably estimated in real time, from on-line torque signature signals. This is very useful since some of the parameters required by the model, such as friction and diameter of screw, are difficult to measure. Experimental results are presented to validate the estimation procedure.