Product Quality Inspection and Optimization Evaluation Based on GPS

Hanbin WANG*1, Chaoyang WANG[1], Xiaohuai CHEN[2], Zhichun ZHOU[1], Zhen LIU[1], Yinbao CHENG[3], Hongli LI[2]

*1,Fujian Metrology Institute, China; wanghanbinbin@163.com
2, Hefei University of Technology, China 3, Beihang University, China

Keywords: Geometrical Product Specifications(GPS),conformity assessment, measurement uncertainty, misjudgment probability, Coordinate Measurement Machine (CMM)

Evaluating the measurement uncertainty reliably and estimating the misjudgment risks of product inspection based on it, have an important significance for enhancing the reliability of product inspection results.

The uncertainty evaluation and misjudgment risk estimation for product inspection are studied. According to the measurement uncertainty, the conformity assessment interval is divided into conformance zone, non-conformance zone and uncertainty zone. The misjudgment risks caused by the products whose measurement results fall into the uncertainty zone are studied. The misjudgment probability estimation formulas for product inspection are derived respectively based on absolute probability and conditional probability models. Based on the distribution of the measurement uncertainty, the conformity assessment and misjudgment probability calculation methods for the measurement results are studied.

The optimization technology for the uncertainty evaluation in product inspection is studied. Based on the Bayesian statistical inference, through integrating the statistical controlled production information into the product inspection results, the measurement results and their uncertainties are reestimated, which reduce the evaluation results of the measurement uncertainties significantly.

The Coordinate Measuring Machines (CMMs), which are widely used in product inspection, are taken as the research example. The measurement uncertainty is evaluated through the measurement system analysis method. Conformity assessments for a batch of products are simulated, and a product inspection experiment is conducted. Results show that integrating prior production information into the product conformity assessment can effectively expand the range of conformance zone.

[1] E. Desimoni， B. Brunetti: Uncertainty of measurement and conformity assessment:a review. Analytical and Bioanalytical Chemistry Vol.400,(6), pp.1729-41 ,2011.

[2] ISO 14253-1:2013，Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1：Decision rules for proving conformity or nonconformity with specifications.