An Innovative Optical-Based Method and Automation System for Rapid and Non-Destructive Measurement of the Web Thickness of Microdrills

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An Innovative Optical-Based Method and Automation System for Rapid and Non-Destructive Measurement of the Web Thickness of Microdrills

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Abstract

In this paper, an innovative optical-based method and automation system for measuring the cross-sectional web thickness of microdrills is introduced. The presented measuring method is a rapid and non-destructive means based on the use of an optical micrometer (OM) as essential equipment to determine the cross-sectional outer diameter and the dual cross-sectional flute depths of the microdrill. To this end, the OM must be set to a particular orientation so that the included angle between the optical measuring plane of the OM and the central axis of the microdrill is consistent with the helix angle of the helical flutes of the microdrill, and the microdrill must be rotated around its central axis for implementing the measurement. The cross-sectional web thickness of the microdrill can thus be calculated through the difference between the determined cross-sectional outer diameter and dual cross-sectional flute depths. An optical-based measuring automation system was constructed for implementing the proposed method through an established automated measuring process. Experiments to measure the web thickness of microdrill samples were conducted. It showed that the presented method and automation system could achieve good repeatability and accuracy with sufficient efficiency. The proposed measuring method, combined with the constructed measuring automation system, had been validated feasible and effective for the web thickness measurement of certain microdrills.

***Keywords*:** Microdrill; Web thickness; Non-destructive measurement; Optical micrometer; Machine vision; Automation system

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