

## Accepted Manuscript

Title: Radial throw in micromachining: Measurement and analysis

Author: Sudhanshu Nahata Recep Onler Shivang Shekhar  
Emrullah Korkmaz O. Burak Ozdoganlar



PII: S0141-6359(17)30755-9  
DOI: <https://doi.org/doi:10.1016/j.precisioneng.2018.04.005>  
Reference: PRE 6759

To appear in: *Precision Engineering*

Received date: 18-12-2017  
Revised date: 14-3-2018  
Accepted date: 6-4-2018

Please cite this article as: Sudhanshu Nahata, Recep Onler, Shivang Shekhar, Emrullah Korkmaz, O. Burak Ozdoganlar, Radial throw in micromachining: Measurement and analysis, *Precision Engineering* (2018), <https://doi.org/10.1016/j.precisioneng.2018.04.005>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Radial Throw in Micromachining: Measurement and Analysis

Sudhanshu Nahata<sup>a</sup>, Recep Onler<sup>a</sup>, Shivang Shekhar<sup>a</sup>, Emrullah Korkmaz<sup>a</sup>,  
O. Burak Ozdoganlar<sup>a,b,c,\*</sup>

<sup>a</sup>*Department of Mechanical Engineering, Carnegie Mellon University, Pittsburgh,  
Pennsylvania, 15213, USA*

<sup>b</sup>*Department of Material Science and Engineering, Carnegie Mellon University, Pittsburgh,  
Pennsylvania, 15213, USA*

<sup>c</sup>*Department of Biomedical Engineering, Carnegie Mellon University, Pittsburgh,  
Pennsylvania, 15213, USA*

---

## Abstract

This paper presents a comprehensive approach for measurement and analysis of radial throw and the associated tool-tip trajectory in micromachining when using ultra-high-speed (UHS) spindles. The effect of radial throw on micromachining accuracy could be significant due to the strict absolute-tolerance requirements. However, accurately determining radial throw in micromachining poses challenges due to the micron-scale tool dimensions and high rotational speeds. In contrast to *run-out*, radial throw depends on the tool-rotation angle and dictates the instantaneous position (trajectory) of the cutting edges. This work first presents a mathematical framework to obtain the radial throw at the cutting edges by measuring radial throw at two locations on the tool shank. A laser Doppler vibrometry-based experimental approach is then described to accurately measure the radial throw from the tool shank in two mutually-perpendicular directions. Next, the variations on radial throw measurements are evaluated, the effect of spindle speed on the radial throw is analyzed, and

---

\*Corresponding author: ozdoganlar@cmu.edu

<sup>1</sup>Phone: +1 (412) 268-9890

<sup>2</sup>Fax: +1 (412) 268-3348

Download English Version:

<https://daneshyari.com/en/article/10226489>

Download Persian Version:

<https://daneshyari.com/article/10226489>

[Daneshyari.com](https://daneshyari.com)