Development of an Active Fixture for Ultrasonically Assisted Micro Electro-Discharge Machining

By: Mollik, MS (Mollik, Md Shohag)[1]; Noor, WI (Noor, Wazed Ibne)[1]; Saleh, T (Saleh, Tanveer)[1]; Bazarah, MGA (Bazarah, Mohammed Gamal Abdulhameed)[1]

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Abstract

Micromachining technologies have enjoyed a recent resurgence due to massive demands in many engineering, production and manufacturing sectors. Micro Electric Discharge Machining (mu-EDM) is one of the most popular techniques available to produce microscopic features and components for various industries. This technique can ensure better machining performance in terms of reduced Heat Affected Zones and surface finishing. It also comes with inherent disadvantages such as high machining time, low material removal rate (MRR) and unstable machining. To overcome these factors vigorous flushing of dielectric fluid is performed. The flushing is achieved through imparting ultrasonic vibration on either of the tool, dielectric fluid or workpiece. The vibration aids in carrying away the debris accumulated in the spark-gap region. In this paper, a novel design of an ultrasonic vibration fixture has been proposed. This fixture will facilitate vibration of the workpiece that is required to improve machining performance. Further enhancement of the design leads to better machining performance. System Identification helps to determine the nature of the system and model the input-output response. The oscillation of the system can be easily characterized and validated using System Identification. Machining results are compared to gain some more insight about the nature of ultrasonic vibration assisted mu-EDM.

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Author Information

Reprint Address: Mollik, MS (corresponding author)

[+] Int Islamic Univ Malaysia, Dept Mechatron Engn, Autonomous Syst & Robot Res Unit, Kuala Lumpur 53100, Malaysia.

Addresses:

[+] [1] Int Islamic Univ Malaysia, Dept Mechatron Engn, Autonomous Syst & Robot Res Unit, Kuala Lumpur 53100, Malaysia

E-mail Addresses: iiums7198@gmail.com; mechatrons138@gmail.com; tanveers@iium.edu.my; Mbazarah2022@gmail.com

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