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A NEW SENSING SYSTEM TO MONITOR ABRASIVE WATERJET NOZZLE WEAR

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Abstract

A wear sensor system for direct and almost on-line tracking the wear of an abrasive waterjet (AWJ) nozzle is proposed. The wear sensor is based on the conductive loops which will be placed on the ceramic's substrate and embedded on the tip of the nozzle. At the heart of this wear sensor system is a wear sensor probe which includes conductive loops divided into four sections. In this arrangement, each conductive loop includes a wearable conductive portion embedded at a particular location within the tip of the AWJ nozzle. The integrity or wear condition of the AWJ nozzle is indicated by the electrical closed or open circuit condition of each conductive loop. The continuity status of each wear sensor probe is converted to logic one or logic zero digital data information which are sampled periodically by a central processing unit (CPU) for providing a visual or audible indication in response to a predetermined erosion or wear condition. Additionally, the CPU is programmed to analyze collected wear data in order to determine the direction of the wear propagation and to provide the information to the controller to compensate for the increase in the AWJ nozzle inside diameter.

1. INTRODUCTION

The abrasive waterjet (AWJ) cutting technique is one of the most recently introduced machining methods. In this cutting technique, a thin, high velocity waterjet accelerates abrasive particles that are directed through an abrasive waterjet nozzle at the material to be cut. Advantages of abrasive waterjet cutting include the ability to machine hard materials, minimal heat build-up and few deformation stresses within the machined part, exceptional surface quality and metal removal rate, and omnidirectional machining that is ideal for automation.

One of the most critical parts that influences the technical and economical performance of an abrasive waterjet cutting system is the AWJ nozzle. The detection of the AWJ nozzle wear is currently performed