



Machine Tool Accuracy Analysis

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Abstract:

CNC machining is an essential part of almost all manufacturing industries. Machine accuracy is a major concern especially to the automotive and aerospace industries where parts with free formed surfaces are made for esthetics and aerodynamic purposes. Machining free formed surfaces require intricate coordination between machine tool axes. This research studies and characterizes the positional error in a 3-axis highspeed machine centre.



KGM-182 Measurement Unit, Heidenhain Corp.
<http://www.heidenhain.com>

Conclusion:

The results from this research will contribute to the ongoing research at the MMRI of characterizing and minimizing errors in the process of producing free formed surface parts from CAD drawing to final part inspection. The ability to produce and inspect accurate free formed surface parts will reduce costs tremendously for many industries, and increase efficiency for automotive and aerospace components.



Matsuura LX-1 Highspeed Machine Centre
<http://www.matsuura.co.jp>

Experimental Equipment and Setup:

Most of the experiments will be carried out on the Matsuura LX-1 highspeed machine centre in the MSL (Machining Systems Laboratory) of the MMRI. The LX-1 is a state-of-the-art highspeed machine having a 60,000 rpm maximum spindle speed, 90 m/min rapid feed, and 1.5g of acceleration. It is driven by linear motors with linear scale feedback system to provide the highest possible machining accuracy.

The KGM-182 optical measurement unit by Heidenhain Corporation is used to measure the positional error of the machine in any two dimensional plane with a measurement step of down to 0.01 μm . Using this information, we can determine the affect of machine motion systems to the error of a produced part. This is part of an ongoing research at the MMRI where we break down the contribution to part error into CAD/CAM errors, machine motion errors, errors in the cutting process, and CMM measuring error.



Siemens Westinghouse – 501G Gas Turbine Engine
<http://www.siemenswestinghouse.com/en/gasturbinesitem/>