OPTIMIZATION FOR RE-CONFIGURABILITY IN MODULAR RECONFIGURABLE MACHINE TOOLS

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ABSTRACT

This paper proposes component level optimization of Reconfigurable Machine Tool by considering its design reconfigurability in configurable machine tool designs. The potentiality of a configurable system is to be reconfigured and allows to perform well under different consider loading conditions in different configurations. The Performance is measured in this paper as machining accuracy, subject to structural limitations. The ADAMS, Ansys, MATLAB/SIMULINK softwares are used to enable the component level optimization. In this paper the Configurable Machine tool will be taken for Optimization process and to achieve the Optimized Components to enable Reconfigurability in Configurable machine tool components. The algorithm for Component level optimization is developed in the MATLAB/SIMULINK software.

Keywords: Reconfigurable, ADAMS, MATLAB/SIMULINK#


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1. INTRODUCTION

Typically, component or structural level design optimization is carried by means of considering the structural performance of machine tool and its design based on the optimization process for a single load case. Predictably the structural performances of machine tools are stress, mass, deformation, or natural frequencies induced in the machine tool. Another important aspect is in structural optimization the configurable machine system is loaded under various conditions. This paper proposes a new design optimization technique that deals with structural (component level) optimization by considering various different loading conditions arises in its configuration variations.

The loading conditions are assumed to the structure and it never be applied simultaneously. The task is not to make the system unresponsive, but to make it reconfigurable such that the machine tool can deal with the assumed various loading conditions well. While the robust design is a inactive response to different loading conditions,
the design for reconfigurability is an active response. The incorporation of this reconfigurability into structural design can lead to major advantages such as reduced manufacturing cost, increase sustainability of machine tool.

2. MATERIALS AND METHODS
The figure shows the basic methodology of component level optimization of reconfigurable machine tool in that a set of structural components for the various configuration are taken into consideration, these components are analyzed and optimized by means of considering operating conditions to satisfy different configuration.

The satisfied components are taken individually and not-satisfied components are considered for optimization based on gradient based optimizer to satisfy the configuration requirement of reconfigurable machine tool.

![Figure 1 Design Methodology](image-url)
3. RESULTS AND DISCUSSION

3.1 Reconfigurable Machine tool Simulation in ADAMS
The Reconfigurable machine tool Model is Simulated in the ADAMS Environment and the joint and tool forces are calculated, these joint forces are considered as a Structural load for the Reconfigurable Machine Tool.

3.2 Reconfigurable Machine tool Simulation ADAMS model
After getting Results from ADAMS the RMT model is Analysed in Ansys the force from ADAMS are given into the structure and the Stress Values of the RMT are calculated then the Variable and Objectives for the Component are selected and design optimization for reconfigurability is now applied to an RMT.

3.3 Component Level Design requirements
Designing a component that can assist all load cases for structural design. If all load differences are considered during structural design optimization. And also the component for different configurations is the attempt for the component level design optimization. The Reconfigurable Machine Tool designs resulting from optimization in which all different loading cases are considered at-once is nearly equal. This is cause of the fact of loading conditions, that the two load cases considered are same images of each other. This structural design is incapable since the one structural design must adapt all loading conditions.

Figure 2 RMT Adams Model
3.4 Von mises Stresses for Different Configuration

Von mises Stress For Configuration I

Von mises Stress For Configuration II

Based on the Stress values from the Reconfigurable Machine Tool, the weak component will be taken into the component level Design Optimization process, the component level Elemental Stress values are considered and the Objectives of the Stress component are set in the Ansys Environment. The results from component level design optimization process are given below.
CONCLUSION

The structural optimization for reconfigurability in machine tool, all the models from CAD software CATIA and exported to the ADAMS there the joint forces of the Machine tool will be analyzed and the Reconfigurable machine tool model are modelled in Ansys based on the parametric modelling concepts, and the structures, analysis of the Reconfigurable machine tool is analyzed using the ANSYS software. Based on the results of machine tool system the optimization of the machine tool components of the desired requirements is identified and the parameter based optimizations are carried out to get the optimized RMT components for achieving reconfigurability in machine tool component.

For the automation of Optimization process the Co-simulation is carried between Ansys/MATLAB SIMULINK, the Algorithm is developed in MATLAB

REFERENCES


