# ANALYSIS OF STATIC STIFFNESS AND NATURAL FREQUENCY OF THE SPINDLE SYSTEM

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**ABSTRACT**

A SPINDLE OF A MACHINE TOOL MUST BE DESIGNED TO PROVIDE THE REQUIRED PERFORMANCE FEATURE -S.SOME FACTORS, SUCH AS BEARING'S TYPE, BEARING SPAN, BEARING PRELOAD AND LEVEL OF TOOL HOLDER'S PULL-IN FORCE WILL AFFECT THE SPINDLE'S STATIC AND DYNAMIC CHARACTERISTICS.THE CO -MPLICATED RELATIONSHIPS BETWEEN THESE FACTORS ARE URGENT TOPICS TO BE STUDIED. BEARING IS ONE CRITICAL COMPONENT OF SPINDLE. SEVERAL DESIGN PARAMETERS MUST BE PROPERLY SELECTED BY THE DESIGNER. IT IS EVIDENT THAT HIGHER PRELOAD WILL PROVIDE HIGHER STIFFNESS .HOWEVER, THIS WILL LIMIT THE MAXIMUM ROTATIONAL SPEED. IN OTHER WORDS, LOW PRELOAD WILL R -ESULT IN AN UNACCEPTABLE DEFLECTION OF SPINDLE, OR WILL CAUSE CHATTERING AND NOISE WHEN M -ACHINING.NUMEROUS STUDIES HAVE BEEN PUBLISHED REGARDING TO THE DETERMINATION OF THE OPTIM -UM BEARING SPAN OF MACHINE TOOL SPINDLES WITH TWO BEARINGS.HOWEVER,MOST OF THE SPINDLES O -F MACHINE TOOLS ARE EQUIPPED WITH MORE THAN TWO BEARINGS.CAN SIMPLIFIED TWO-BEARINGS MODE -L BE USED TO DETERMINE THE OPTIMUM SPAN OF THE FAR MORE COMPLICATED THREE OR FOUR-BEARING SYSTEM? THE PURPOSE OF THIS RESEARCH IS TO DETERMINE THE DIFFERENCE BETWEEN THE STATIC PERFORMAN -CE OF A REAL SPINDLE MOUNTED WITH FOUR ANGULAR CONTACT BEARINGS AND THAT OF THE SIMPLIFIE -D MODEL.SEVERAL DIFFERENT 7/24 TOOL HOLDERS AND DIFFERENT PULL IN FORCE OF DRAWBAR SYSTEM ARE SELECTED TO EXAM THE SPINDLE'S STATIC STIFFNESS.THE FINITE ELEMENT(FE) ANALYSIS SOFTWA -RE PACKAGE"I-DEAS" IS UTILIZED TO BUILD THE SPINDLE'S FINITE ELEMENT MODEL.THE SPINDLE'S STATIC AND DYNAMICS CHARACTERISTICS WERE SIMULATED WITH SEVERAL DIFFERENT BOUNDARY CONDITI -ONS.THE EXPERIMENTAL AND SIMULATION RESULTS WERE THEN COMPARED TO ENSURE THE FE MODEL'S A -CCURACY.RESULTS SHOWED THAT THE DEFLECTION OF THE SPINDLE HOUSING IS SIGNIFICANT.THE SIMP -LIFIED MODEL THAT DID NOT CONSIDER THE DEFLECTION OF THE SPINDLE HOUSING CAN NOT PREDICT THE STATIC STIFFNESS OF THE SPINDLE ACCURATELY. I WISH THAT THE CONCLUSIONS FOUND IN THIS RESEARCH IS HELPFUL TO THE MACHINE TOOL INDUSTRY.

Keywords : MACHINE TOOLS, SPINDLE, STATIC STIFFNESS, DYNAMIC CHARACTERISTC, ANGULAR CONTACT BALL BEARING, 7/24 TOOL HOLDER, FINITE ELEMENT

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