Active Vibration–control Device for Precise Boring of a Deep Hole for Large Integral Structure

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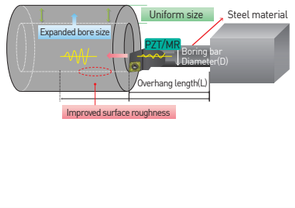
Reduce vibration and improve surface roughness through active vibration proof during precise boring of a deep hole for large integral structure (aspect ratio over 7D)



Client / Market

- Machining–tool manufacturer / Machine–tools manufacturer

Necessity of this Technology

- Vibration and low surface roughness intensity while boring a deep hole in a large integral product is an issue.
- With the aspect ratio over 4D, it is difficult to secure surface roughness due to vibration that the parts are processed with the module and then welded.
- Passive methods using damper or vibration proof machine are usually adopted, but it cannot be used for a hole greater than 7D.
- Recently, deep hole processing has become frequent for a large integral product (aircraft landing gear, large motor/display, wind power facility, etc.).
- In particular, boring process requires precision, and to secure surface roughness (usually up to 2 μm), periodic damping (damping ration over 30%) is required during the deep hole work.
- Active vibration proof technology is an alternative technology.

Technical Differentiation

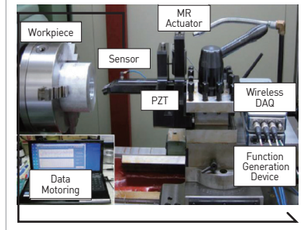
- By measuring the vibration real–time using the adaptive active damping with anti–vibrating of frequency of occurred vibration and offsetting such vibration (destructive interference through deducting the main frequency and phase modulation of frequency in possession), the accuracy of machine tool process work can be improved, and the life of the machine tool can be extended by reducing vibration, and these lead to a great cost reduction effect.
- Under the aspect ratio over 7D, precise boring of a large integral product can be done with the roughness between 1.8 μm and 2.0 μm; since the process of disassembling and welding back is no longer necessary, reduced number of processed parts and frequency of processing lead to short processing time and improved precision and productivity.

DESIRED PARTNERSHIP

Technology Transfer | Licensing | Joint Research | Other

TECHNOLOGY READINESS LEVEL [TRL]

Research, basic explanation | Project concept or idea development | Technology idea verification | Prototype development | Trial product production/ evaluation in similar environment | Pilot field demonstration | Development and optimization of commercial model | Commercial product demonstration | Mass production and initial market launch



Signal Detect → Amplifier → A/D Convert → Wireless → Communication → Data Acquisition

- From the control aspects, the embedded active vibration control and CNC–linked autonomous correction control mechanism are excellent.
- From the structural aspects, the detachable design of vibration proof boring device is excellent.
- From the process expansion aspects, fixed/rotary periodic damping can be done.
- From the interface aspects, wired/wireless data high–speed/high–resolution data collection and filtering is excellent.

Excellence of Technology

- After the frequency and wave estimation stage estimating the main frequency and wave using the vibration size and Fourier transform signal and measurement of the actual vibration amplitude of the vibration source, the amplitude for destructive interference is decided to actively control damping.
- Previously, the precision processing used a passive method of using vibration proof machine or damper, but this method is the world's first active method.
- Five SCI–level papers related/based on the technology have been published (1 author) on JMST, IJPEM, and Key Eng.; over 20 years of research experience in machine intellectualization field
- Received the 2012 Korea Society of Mechanical Engineers Baekbong Technology Excellence Award, 2011 KIMM Academic Award, and 2007 ICROS Academic Award.

Current Intellectual Property Right Status

PATENT

- Machine Tool Vibration Reduction Device and Method (KR1436984, PCT/KR2013/008236, US14/128709, JP2014–539893)
- Detachable Active Vibration Proof Device and Method Using MR Vibrator and Piezo Vibrator (KR1510638)
- Machine Tool Chatter Vibration Compensating Device (KR1015058)
- Active Vibration Reduction Device Using MR Fluid (KR1321468)

KNOW–HOW

- Active vibration–control based machining technology for large integral product
- High–speed precision boring processing and active chatter vibration reduction technology