



Whitepaper

# Using Self-Tuning Mass Dampers to Eliminate Vibration in Cutting Tools

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# Statement of problem

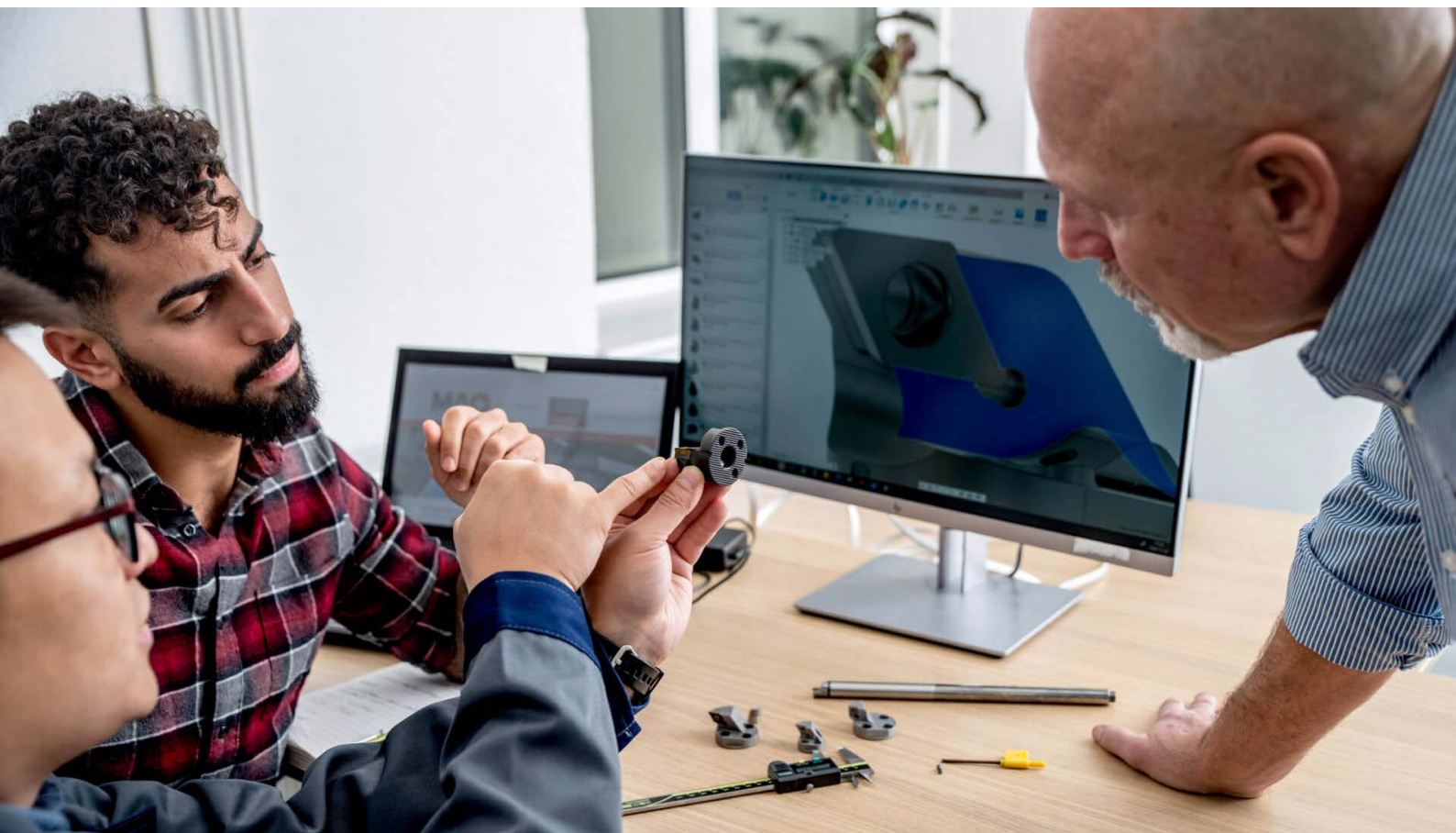
Vibration occurs naturally in metalcutting processes. It can be stable or unstable. (i.e., regenerative chatter in the tool) When severe, unstable vibration occurs, it disrupts the cutting process by causing tool breakage and damaged surfaces. In contrast, when a cutting tool operates under stable vibration, the machining can continue, but at the cost of fast tool wear and unpredictable surface quality.

Vibration damping technology is needed on cutting tools to eliminate vibration, and a mass damper is a cost-effective solution commonly used. For mass dampers to efficiently eliminate vibration from a cutting tool, its resonance frequency must match the

cutting tool's vibration frequency. Otherwise, the mass damper will fail, and the cutting tool will vibrate.

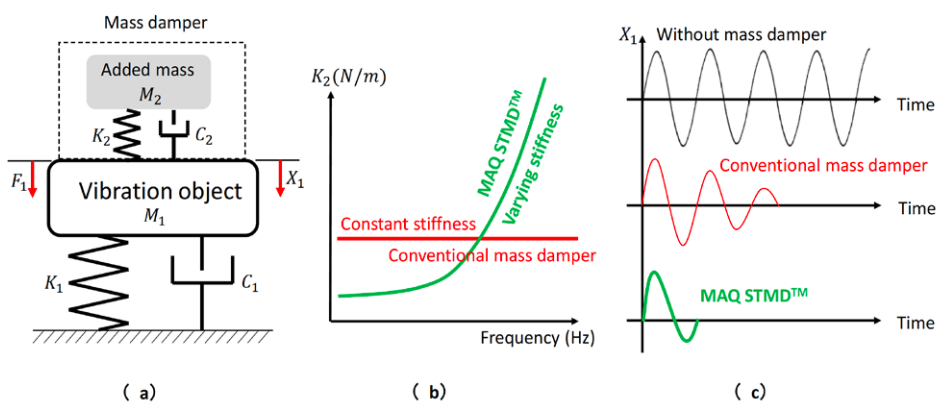
All machine tools are different. (e.g., big, small, long, short, new, old) Such variation makes the machine tool's vibration frequency unpredictable, as various tools vibrate at multiple frequencies. Currently, mass dampers on cutting tools are difficult to use because they are either tuned to a certain frequency, or they need frequent tuning to ensure vibration damping efficiency.

MAQ has invented Self-Tuning Mass Damper (STMD™) technology that resolves this specific problem.



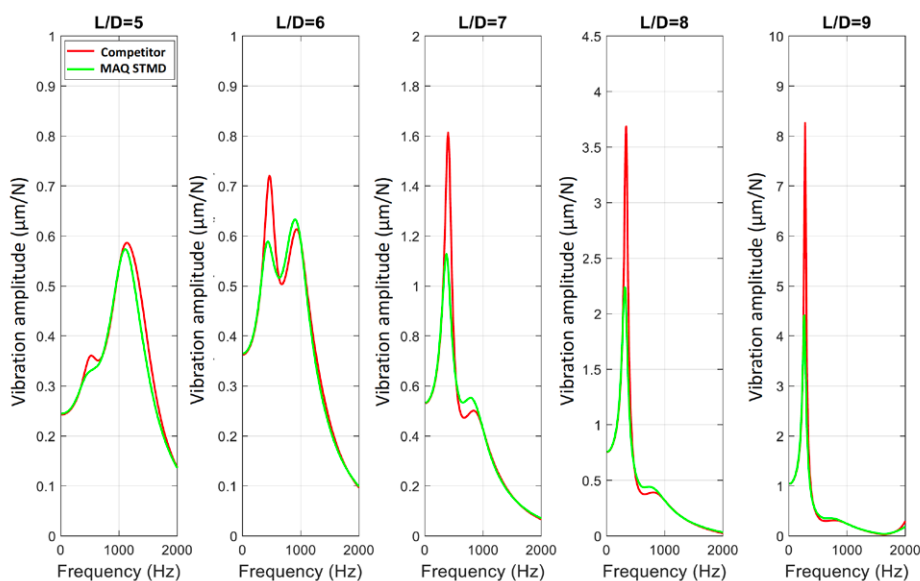
# The Innovative Self-Tuning Mass Damper (STMD™)

STMD™ products have materials that change their stiffness according to vibration frequency. When frequency is high, stiffness is high, and vice versa. These materials enable the self-tuning function on mass dampers, and the STMD™ product adapts itself to your machining conditions.



**Figure 1.** Schematic view of the STMD™ technology in comparison to conventional mass dampers

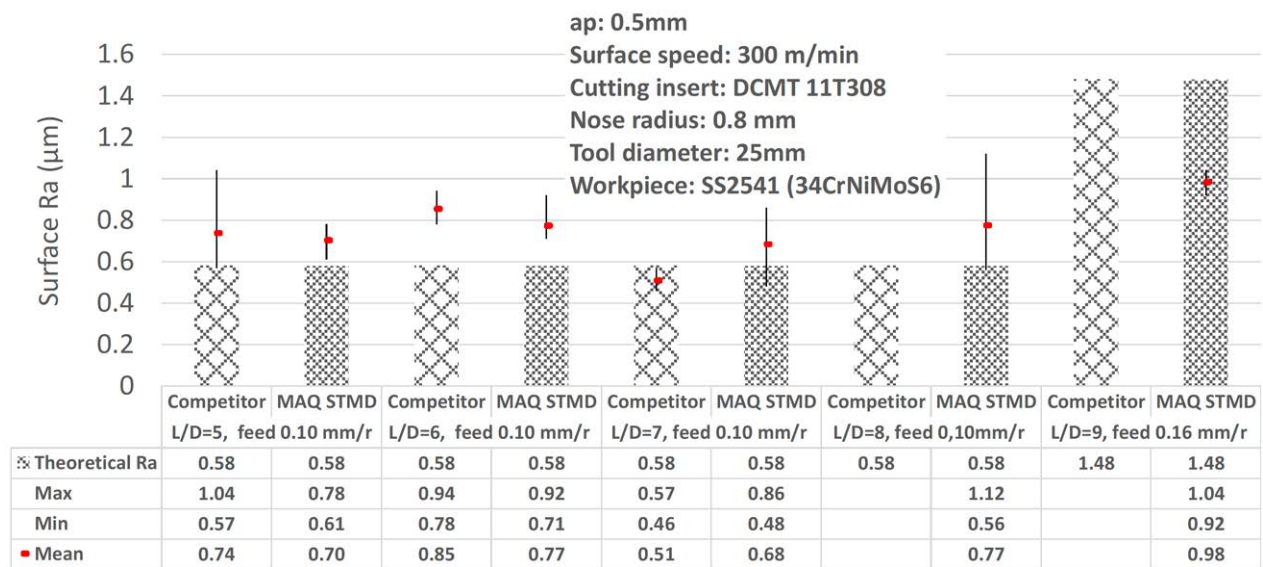
Using a turning tool as an example, the tool may be set up at different lengths for machining different parts. The longer the overhang length, the lower the vibration frequency, and vice versa. The tool will vibrate at different frequencies depending upon overhang length. STMD™ products cover a wider frequency range, correlated to L/D (length to diameter) ratio.



**Figure 2.** Vibration amplitude comparison between competitor and MAQ STMD™ products used on a cutting tool at different L/D ratios.

# Productivity Enabled by MAQ STMD™

Cutting process parameters (speeds and feeds) are conservative when the risk of unstable vibration is considered. With STMD™ technology, there is no need to worry about vibration when you press the “start” button.



**Figure 3.** Surface finish comparison between a competitor's products and MAQ STMD™ products used in a turning process

High speed machining excites multiple frequency vibrations on cutting tools, and MAQ STMD™ will adjust itself to damp high and low frequencies automatically. With MAQ STMD™ inside, you will be able to cut at high speed and feed rates.

**See our demo video of the MAQ STMD™ at a speed of 500 m/min with an 11 L/D ratio.**

[Watch demo video](#)

# Read more about our technology

Learn how the MAQ vibration damped tool holder with STMD™ can benefit you, whether you're a Job Shop Owner, Plant Manager, Manufacturing Engineer, Machine Programmer, Machine Operator, Machine Tool Builder, Distributor, Buyer/Purchasing Agent, or Cutting Tool Manufacturer.

[Read more on our web](#)

