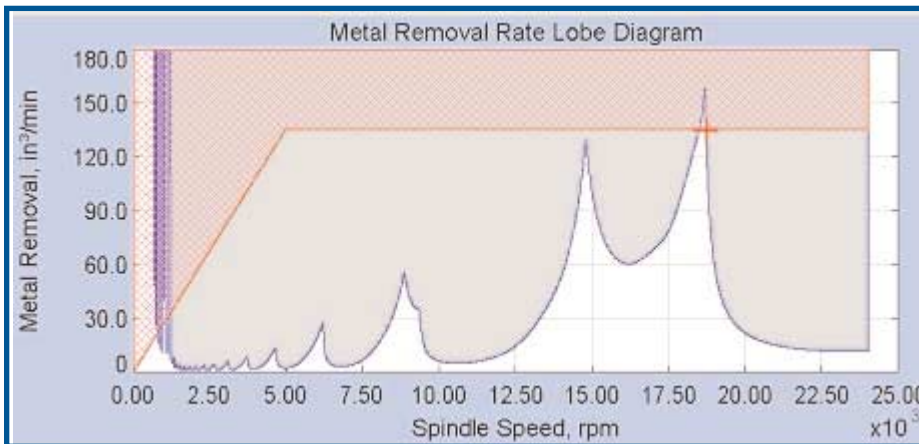
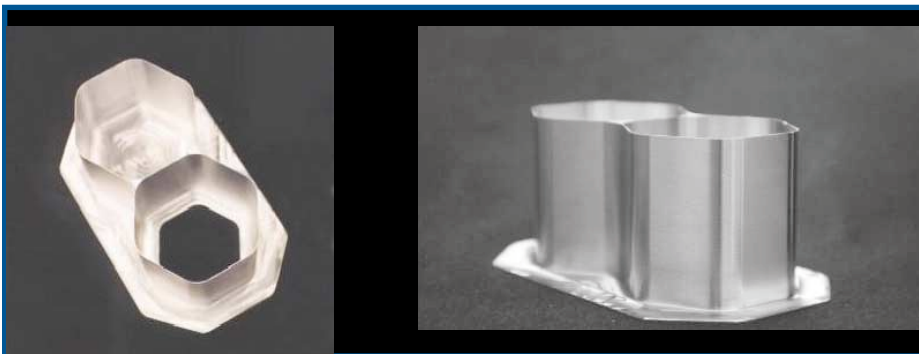


METALMAX™

The COMPLETE Package for Machine-Tool Dynamic Characterization



MetalMAX™ maximizes a machine tool's productivity with diagnostic tools that make fast, accurate cutting performance predictions. Optimize production output by selecting process parameters (cutting depths, speeds, feed rates) without test cutting. The MetalMAX™ approach provides a systematic and objective means to compare tool stack-ups, match the best machine with the best cutting tool, and trouble shoot machining problems. The user can also apply measurements to preventive maintenance of spindles and machine tools for additional cost-savings. MetalMAX™ is the most complete, lowest cost dynamic characterization package for machine tools. The first solution available to provide essential cutting data for optimized NC programs.



Aircraft-Coupon using MetalMAX™ system to optimize end-milling cutter performance (4-flute, 3/4" dia., 4" length, carbide). Machined from 4"x6"x4" solid aluminum block in 24 minutes using a single tool. 0.020" thick walls and floor with near RMS 32 surface finish.

Important Features:

- **ELIMINATES CHATTER!!**
- **30% minimum improvement in machining productivity.**
- **Easy to Operate, Fast, User Friendly.**
- **Cost effective: Savings from one production run can cover investment.**
- **Eliminates finger pointing, objectively determines the weak link (tool, holder, spindle, fixture, etc.).**
- **Utilizes leading edge techniques, software and hardware.**
- **Scientifically predicts best spindle speeds, depths of cut and feed rates.**
- **Recognized worldwide by universities and major machine shops.**
- **Lowest cost, most complete system available.**

Manufacturing
Laboratories,
Inc.
MLI
(www.mfg-labs.com)



What is MetalMAX™?

MetalMAX™ includes all the necessary hardware and software for performing what is known as “modal” testing (Frequency Analysis) and data acquisition. It processes very quickly and easily this information into useful cutting parameters (DOC's, Speeds, and Feed Rates). MetalMAX™ contains dynamic measurement and simulation software for dynamic cutting performance prediction (e.g. chatter limits). High-performance data acquisition systems verify predictions and fine tune chatter free spindle speeds. Specifically, MetalMAX™ includes TXF, PCScope, MilSim, CHiPS™, and the Harmonizer®. These software applications are specifically tailored to measurement of machine tools. The “uses” are wide ranging as shown here.

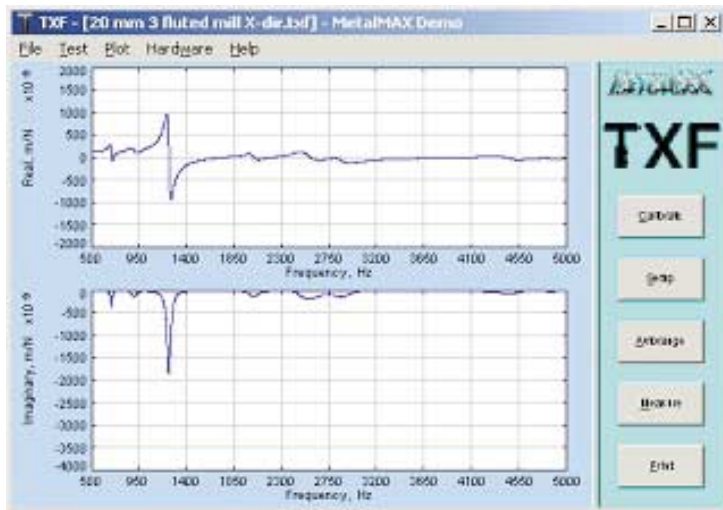


SOFTWARE:

TXF is a very easy to use frequency analysis package that immediately and accurately computes cutting parameters specific to the input material and machining conditions. It computes dynamic data (frequency, stiffness, damping) to make scientific and quantitative comparison of tool stack-ups. Output from TXF is shown at the top of the next page: On the left is a FRF (frequency response function); on the right is a stability-chart that provides stable depths-of-cut and chatter frequencies for all spindle speeds. Machinists or NC-Programmers can use the output to select non-chatter conditions for any cutting configuration (width or depth of cut, direction, cutting power, metal removal rate).

MilSim is a milling simulation program that utilizes the output of TXF to make detailed and accurate predictions of stable depths-of-cut. It additionally predicts cutting force levels, cutter displacements and dynamic cutting accuracy. The package provides the next level of predictability and analysis for use by NC programmers and manufacturing Engineers. Full dynamic vibratory behavior is predicted including resonant conditions. Chip loads (feed rates) can be optimized based on cutting forces and displacements.

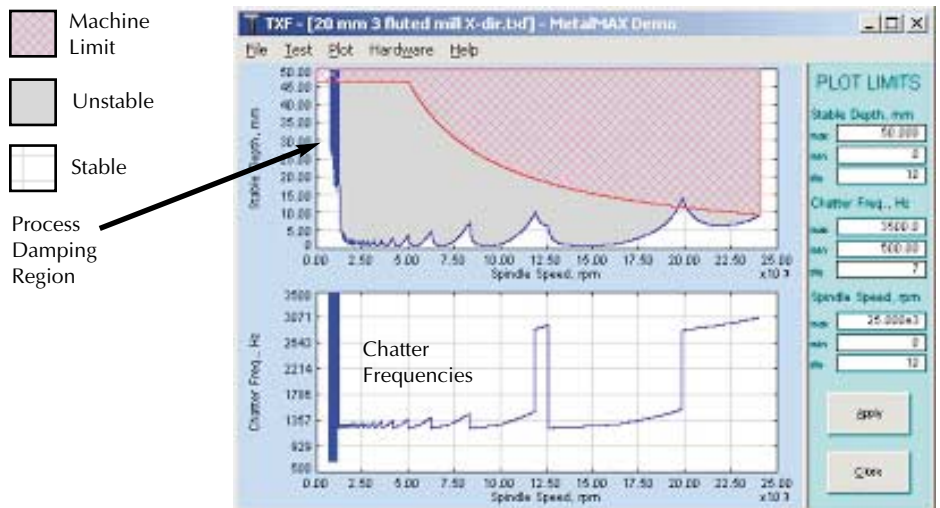
FRF: Frequency Response Function



Input Machining and Material Conditions



Stability Chart



Harmonizer® is a validation and fine tuning tool. TXF™ and MilSim predict the best operating conditions for the cutting tool, fixture and machine. The user operates within these parameters using the Harmonizer® to confirm that no chatter is present and if present the Harmonizer® can additionally suggest further rpm changes to eliminate chatter. By itself, Harmonizer® can be used by leadmen to make fast chatter free tool setups. Refer to the Harmonizer® literature for more information (www.mfg-labs.com).



PCScope is an extremely easy to use data collection package with frequency analysis capabilities. Up to four-signals can be collected at once. The package provides additional monitoring capabilities of any machining measurement, from a microphone to accelerometer or any gauge having up to a +/- 10-volt output signal. Additional features include windowing, harmonic tracking and parsing and storage of samples.

CHiPS™: This dynamic tooling database tracks for easy retrieval all of data collected from MetalMAX™ applications. CHiPS™, which stands for **C**hatter-free **H**i-Performance **S**peeds, provides a consistent and coherent means to manage tooling and tooling changes based on dynamic characteristics. With the dynamic data and optimal cut parameters, it records the standard cutter geometric information (e.g. length, diameter, gage length, flutes, grind history, etc.) in addition to the machine or machine type used, spindle, spindle condition, etc. It is fully customizable by MLI to suit the customer's particular terminology and tooling identification methodology.

The Geometry and Cutting Performance Display of CHiPS.

The screenshot displays the CHiPS software interface. At the top, it shows tool details: Cutter ID No. 30, Description: 1x1x3x6, Style: CARBIDE END MILL BALL, and SFM values (3,364, 1,682, 1,121, 841, 673). Below this, it lists RPM values (12,840, 6,420, 4,280, 3,210, 2,568) and Holder Data including Taper (HSK, CAT), Holder (Shrink-fit, Shell mill, Collet), and Estimated Natural Frequency (428 Hz). The interface also features a central image of the tool and various input fields for cutting parameters like Radial Dia. of Cut, Axial Depth of Cut, and Speed. A 'MEMO' section at the bottom left notes that a tap test was not performed, so the natural frequency was taken from the harmonizer reading. The bottom right section shows Cutting Data for Aluminum, including Specific Power (0.25 hp/in³) and Max speed for cutter (76,336 rpm).

Metal MAX™ "Uses"

ToolCrib

- Optimize and reduce setups

Process Planning

- Compare tool performance.
- Determine optimum Stackup

NC Programming

- Program optimal cutting parameters

Maintenance

- Quick checks of dynamic condition

Production

- Monitor output and maintain stable processes. Realize productivity increases from cut optimization.

Part First Article (Try-Out)

- Easily monitor results and quickly adapt to unknown affects.

MetalMAX™ Hardware includes:

- High-speed Analog-to-Digital computer hardware for installation on any Windows based PC.
- Proprietary signal interface module for precise noise-free measurements.
- Excitation kit consisting of PCB Piezotronics impact hammers and accelerometers specifically selected for each customer's application.
- Microphone and necessary cabling and accessories.
- ABS Carry case.
- Computer can be supplied at cost if requested.

MetalMAX™ system is adaptable to any Windows based computer allowing the user to decide on their platform of choice (e.g. laptop or desktop applications).



**MetalMAX™
Hardware**



Other MetalMAX™ options not included in the base package are the following:

SPA: The spindle analysis package utilizes Finite Element Analysis. It is extremely easy to use and quickly evaluates spindle designs and predicts performance of modeled tool, holder and spindle stack-ups.

Future Predictive Simulation Packages: Drilling, Reaming, Boring, Turning, Grinding, Hobbing, broaching or Threading packages for almost any metal cutting operation are planned to be directly linked to the TXF MetalMAX™ application with accompanying simulation packages.

Consulting Service: PROACC, is available using the MetalMAX™ package. Call for a quote or additional information.

For pricing information or additional information please contact MLI at:

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