VisualMILL® MecSoft

MAS Automation Systems

VisualMILL® Assists MAS with DOE Research

Most of us today take electricity for granted. We flip a switch and the lights come on – end of story - unless of course, when they don't! With daily power demands ever increasing, supplemental energy is added to the nation's power grid from the Midwest in the form of wind and solar but what happens when demand is up, the wind is calm and the skies are cloudy?

Figure 1 - Heat radiating from the flywheel sample can be seen on the hand help meter

Smart Grid Technology

This is where smart-grid technology comes into play. During peak energy use or when wind and solar contributions are low, stored energy is added to help stabilize the grid in the form of 32 inch diameter carbon fiber composite flywheels similar to the one shown in **Figure 2** below from Beacon Power, LLC in Tyngsboro, MA.

Figure 2 - Flywheel from Beacon Power, LLC in Tyngsboro, MA and the Stephentown, New York facility

Beacon's flywheel is essentially a mechanical battery that stores kinetic energy in a rotating mass. Advanced power electronics and a motor/generator convert that kinetic energy to electric energy, making it instantly available when needed. However, to do so these flywheels must be turning 24 hours a day, 7 days a week. Conventional metal flywheels would crack and fail under these conditions so carbon composite materials are used instead. 200 of these flywheels are located at one Stephentown, New York facility providing 20 MW of electricity to the grid instantly when needed.

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So what's the problem you might ask? These carbon composite flywheels are manufactured from thousands of strands of carbon fibers soaked in a polymer resin and then wound tightly onto a core. Each core is then baked at 200 degrees continuously for about a week to completely cure the 7 inch thick core using technology that has not changed in past 50 years!

MAS Automation Systems is working on research funded by the DOE (Department of Energy) to develop technology that would allow carbon composite flywheels of similar size and specifications to be cured within 45 minutes using high energy – a 4 million electron volt beam/x-ray!

Figure 3 shows the carbon fiber tow line (foreground) being fed into the "*slurry*" where it is coated with a proprietary formula of polymer resin. The tow line itself is a ribbon composed of 3,000 carbon fiber strands (about 0.15 x 0.17 inches).

Figure 3

Figure 4

Once coated, the carbon fiber tow line is then wound onto a spool shown in the background containing internal components designed to exert pressure from the inside out, forcing as much excess resin out of the carbon fibers as possible. The slurry assembly along with the internal components of the spool were manufactured from toolpaths generated using **VisualMILL**, the centerpiece of a comprehensive manufacturing plugin solution developed by MecSoft Corporation. VisualMILL, a standalone Milling module of the VisualCAM plug-in for VisualCAD, offers easy to use 2½ through 5 axis machining strategies as well as Turning and Nesting solutions that work seamlessly with both native and imported CAD geometry.

Figure 4 shows a carbon composite flywheel sample being positioned under a 4 million electron volt beam (called an E-Beam Accelerator) that is focused into an x-ray at the top of the spool (at the white arrow) while the spool is slowly related. The E-Beam Accelerator, owned by IBA and located on New York's Long Island is 3 stories tall with the bottom portion shown here in a room whose lead filled walls are 3 feet thick! **Figure 5** shows a scale model of the E-Beam Accelerator, courtesy of IBA.

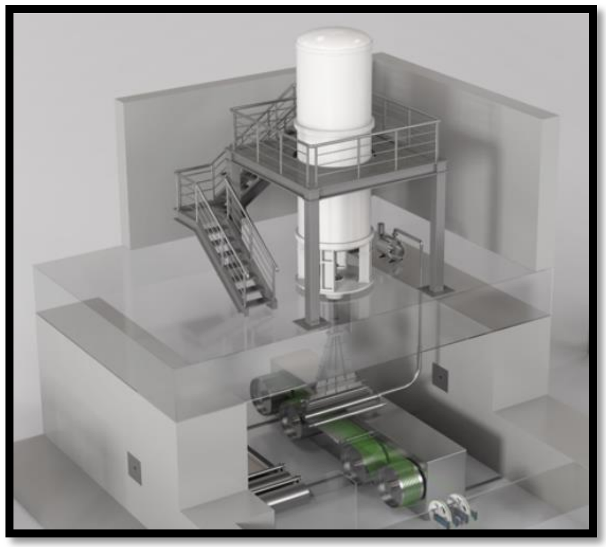

Figure 5

While the electron beam itself only penetrates ¼ inch into the carbon composite flywheel, the x-ray provides complete penetration and curing of the sample within 45 minutes of exposure. The heat radiating from the flywheel sample can be seen on the hand help meter in **Figure 1** above. Using the conventional baking method the same sample size would take about 12 hours to cure.

> *"As I look back at my work, it's hard to believe how much I use Mecsoft. I don't know what I would do without it!"*
>
> **– Mark Sherwin, MAS Automation Systems**

Since 2009, MAS has been using **VisualMILL** to assist them in manufacturing components for use in their automation systems integration projects including the carbon composite flywheel research mentioned above. Mark Sherwin, president of MAS Automation Systems has a background in electronics and is a Control Engineer. Mark initially chose **VisualMILL** because of its ability to generate toolpaths from geometry files created in their Geomagic Design® CAD software. Moving forward, Mark stayed with **VisualMILL** because if its reliability, ease of use and technical support.

Figure 6 is a mold cavity block and **Figure 7** below is a component from the flywheel assembly seen in **Figure 3** above after programming and simulating 2 and 3 axis toolpaths in **VisualMILL**.

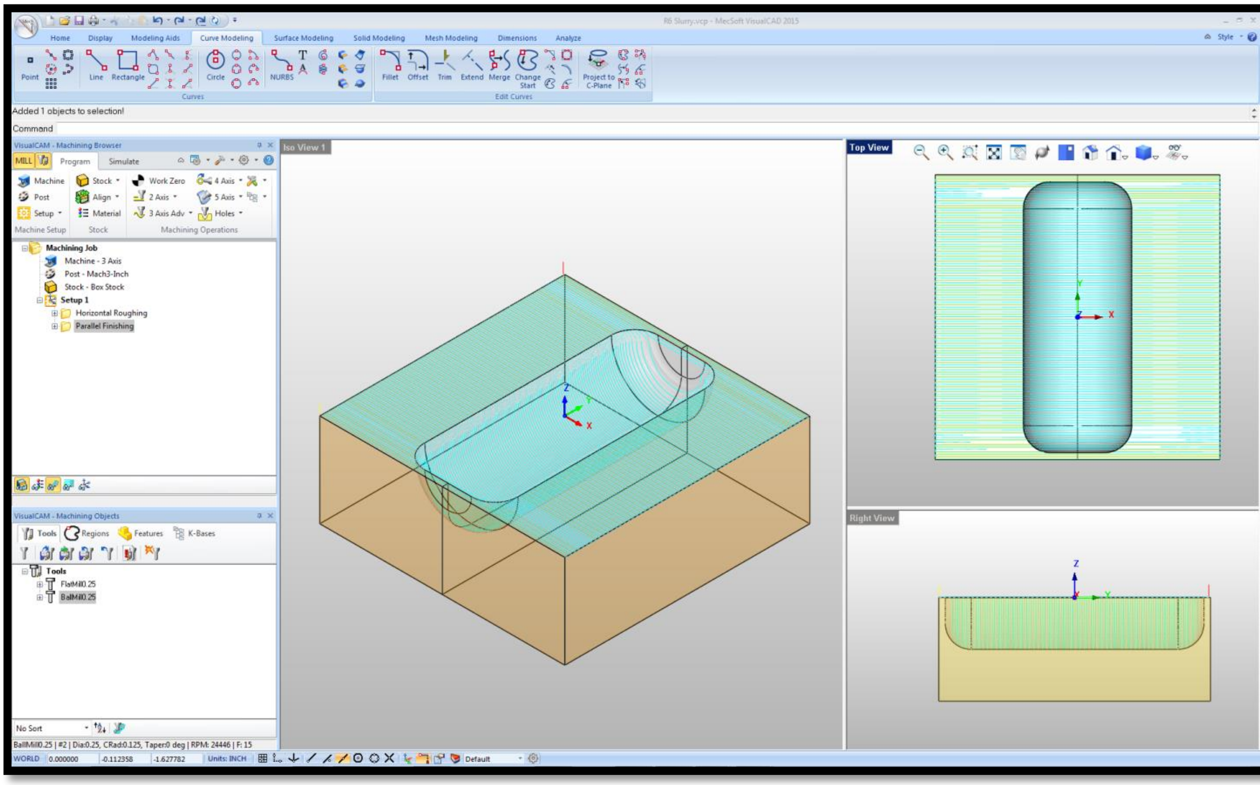

Figure 6 – Mold cavity block showing a Parallel Finishing toolpath

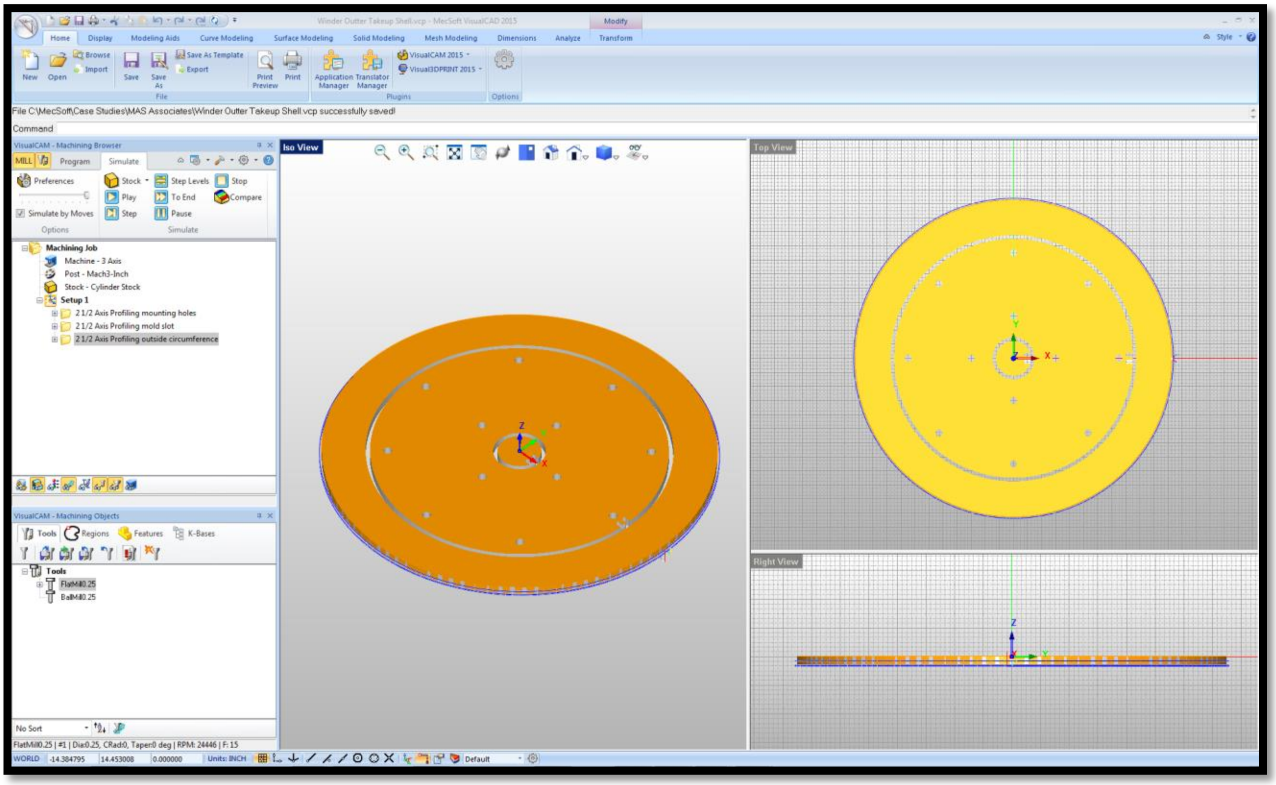

Figure 7 - Component from the flywheel assembly showing simulation of 2½ Axis toolpaths.

Additional Information

- For more information about **VisualMILL** and other **CAD**, **CAM** and **3DPRINT** solutions offered by **MecSoft Corporation**, visit our website at https://www.mecsoft.com.
- For more information about **Mark Sherwin** and projects at **MAS Automated Systems** you can visit them on Facebook at https://www.facebook.com/MASAutomationSystems.
- For more information about **Smart Grid** technology you can visit **Beacon Power** at their website at http://beaconpower.com
- For more information about **E-Beam Accelerators** you can visit the **IBA** website at http://www.iba-industrial.com