reThink Engineering, Inc.

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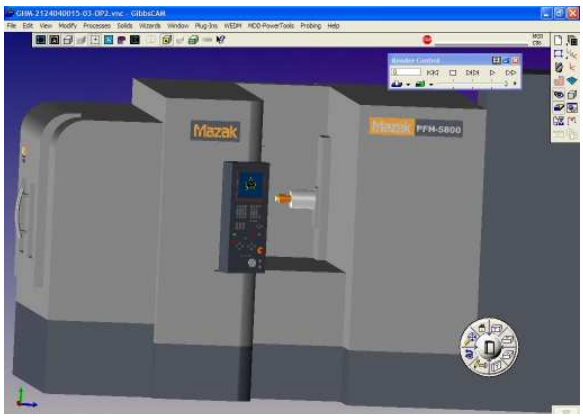
Machine Simulation
Value or Fluff



Eliminate Scrap Parts! Don't Break Tools! Don't Crash Fixtures! Save Your Spindle! These are just some of the claims made by machine simulation vendors. Almost every CAM vendor today offers a machine simulation capability in their packages. This is in addition to the rendering that most CAM applications have showing the tool and part interacting. Most marketing material for CAM software features a screen shot of machine simulation displayed prominently. While very sexy, the question remains. Is machine simulation worthwhile for a CNC part programmer? To answer this question, one must look at all the costs as well as the associated benefits.

The costs of machine simulation can be significant. The first cost is the machine simulation software itself. In most cases, a solids option is required in the CAM software in addition to the simulation module. Depending on how a company is programming today, the addition of solids can exceed $5,000. The machine simulation module adds another couple of thousand.

Once the software platform is in place, the next cost is to get models of machines set up inside the CAM software for the simulation. Some companies just model the work envelope, ignoring the rest of the machine. Machine vendors who sell models tend to have every nut and bolt – far more detail than is needed. If a company has a design department and skilled CAD people, then a model can be developed internally. A skilled developer will usually take 3 to 4 days to model a machine.

Once the machine is modeled, it needs to be integrated into the CAM application. For vendors using MachineWorks, the leading development toolkit for CAM vendors, the CAM application will have a "Build Machine" function. This allows a user to take a solid model of a machine tool and add color, movement, centers of rotation, limits, maximum/rapid speeds, tool attach points, machine zero and collision detection. For an experienced user, this will take anywhere from an hour or so for simple 2-axis lathes and 3-axis mills to several days for multi-axis/multi-spindle lathes and swiss-style machines.

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In addition to doing it yourself, many CAM resellers and vendors often offer services for machine simulation. They will build the machine models for a customer and integrate them on a custom basis. There is a website for GibbsCAM users who can purchase models integrated into GibbsCAM at www.machinetoolmodels.com. Some machine tool companies will also offer the models which then need integration.

Once a machine is integrated into the CAM application, most of the investment is complete. To use the machine simulation software, a user has to program a part and select the machine simulation function. When programming the part, the user will need to fully define tools. If using extensions, form tools, boring bars, etc., the tool must be fully defined or the simulation will be incorrect. In addition, the fixtures must be modeled. Most tool and fixture vendors will have solid models of their products in a parasolid format available on the web, so this is not as difficult as it may seem. The other task that must be done by the programmer is to identify the distance between the programming zero and the machine zero.

Based on experience, simple machines making simple parts can not justify machine simulation. While many companies simulate 2-axis lathes and 3-axis mills, acquiring the technology and models to do this makes little financial sense. As the complexity of the machining process and parts increased, the justification for machine simulation does as well. In 4-axis machining, it is possible to crash into a tombstone or other fixture. As machining moves to 5-axis, the potential for crashes increases significantly. In the multi-task machine world of Mazak Integrex, Okuma Multus and MacTurn, Mori NT series, and other similar machines, machine simulation becomes more critical. There is so much movement going on in the work envelope of these machines that it is difficult to keep track of where everything is at all times without machine simulation.

Justifying machine simulation for 4-axis is usually a break-even proposition. If a company is doing 5-axis milling, the cost is easily justified. The majority of companies programming parts for multi-task machines use machine simulation. The cost for acquiring the technology is easily justified.

In summary, the more complex the part and more complex the setup, the easier it is to justify machine simulation. As companies look for competitive advantages and seek to reduce costs, machine simulation can play a key role. As has been said many times, “it is cheaper to crash pixels than parts!”

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Hamilton, OH, just north of Cincinnati. Mr. Freimuth has been involved in machine simulation for several years and serves on the Machine Tool Model Standards taskforce at NIST. As a CAM software reseller, reThink Engineering has been involved with machine simulation professionally since 2003.