Businesses that thrive can do so in any number of ways, but it all ties back to leaders who are intelligent and innovative. Since the moment of its creation, the Ohio Supercomputer Center has strived to give manufacturers of all shapes and sizes the best tools needed to stay competitive, lean and at the forefront of their industry. How? By leveraging high performance computing and simulation-driven design, companies are able to access expertise and fine-tune their knowledge banks in support of rapid, cheaper development of consumer goods.

Valve Performance

Clippard, Kinetic Vision team up to eliminate flow inconsistencies

When your business is manufacturing valves, predictable and controlled fluid flow is essential. So when Clippard Instrument Laboratory Inc. encountered a proportional valve that wasn't delivering consistent performance, they knew they needed to take a closer look at the issue.

After reaching out to the Ohio Supercomputer Center's (OSC) AweSim program, they were able to do just that—down to the micron.

Doug Robertson, director of engineering at Clippard—a community-oriented company near Cincinnati—and his team initially approached AweSim to help the company segue into the world of high performance computing (HPC) modeling and simulation. Their original project was to predict the performance of a spring in one of their electromagnetic proportional valves. Ideally, the amount of fluid that flows through the valve is controlled by, and proportional to, the amount of electricity running to a solenoid coil that pulls on the spring. Early on, however, the test data on the prototype valve showed a nonlinear trend for flow versus electric current. This was inconsistent with the flow analysis of the computer-aided design (CAD) files of the valve.

In collaboration with AweSim partner Kinetic Vision, a Cincinnati-based engineering service provider, the team

▶ Using simulation through OSC's AweSim program, the team discovered a defect in the valve manufacturing process that allowed Clippard to ultimately produce a more efficient product.

Project Lead: Doug Robertson, Clippard Instrument Laboratory Inc.
Research Title: Spring response simulation
Funding Source: Clippard Instrument Laboratory Inc.
Website: clippard.com

▶ Clippard Instrument Laboratory Inc. has been manufacturing industrial equipment in Cincinnati since 1941.

took a two-pronged approach to finding what was causing the discrepancies between the performance of the physical valve and the computer model.

"One thing we did for them was nondestructive inspection," said Jeremy Jarrett, vice president at Kinetic Vision. "We also helped with finite element analysis. It was really the blend of those two things together which really helped them solve their problem."

By first performing an industrial computed tomography (CT) scan of the assembled valve, the team compared the prototype with the computer model of the valve. They then built a finite element model from the industrial CT scan. From this model, they found that the problem was not with the computer design of the valve, but in the manufacturing process Clippard was using.

"It became obvious that our machine surface was not the shape that we thought it was and that we had asked our computer-controlled machines to (manufacture) for us," said Rich Humason, engineering manager at Clippard.

Because the CT technology scans the entire assembled valve, Kinetic Vision was able to provide Clippard with complete imaging of the entire valve, every piece down to a micron-level view. Thanks to the results provided through modeling and simulation and a quick turnaround, the Clippard team was able to make changes in their computer translation to correct the issue and manufacture a better product.

"The depth, detail and the granularity of this information—they're able to really inspect their parts after they're put together," Jarrett said. "We're actually measuring these parts as they're assembled so they can really see what's going on with the component in its operating state."

As an AweSim charter partner, Kinetic Vision's engineering experts perform their intricately detailed analyses, scans and inspections through OSC resources.

"Having the supercomputer at your disposal makes this type of methodology possible," Jarrett said. "We are solving high fidelity finite element models directly generated from microCT data—it really helps enable that technique to even happen because the models have to be much more detailed."

Since the valve solution, Clippard has developed new methods to measure their material surface, improving processes from initial computational design to the finished product. According to Robertson, modeling and simulation has saved the team valuable time and resources.

"There's no doubt we're sold on simulation," Robertson said. "I'm not sure if we ever really would have put our finger on that as specifically as we were able to without that simulation in our hands." •