



With additive manufacturing, material can be placed only where necessary, helping to reduce component weight and machining costs.

Aidro Hydraulics & 3D Printing (A Desktop Metal Company)

ADDITIVE MANUFACTURING Brings Opportunities to Improve Component Design and Production

New design options and reductions to production time and costs are possible with additive manufacturing.

by Sara Jensen

Additive manufacturing—also commonly referred to as 3D printing—continues to make headway in many industries, including fluid power.

Valeria Tirelli, president & CEO of Aidro Hydraulics & 3D Printing (a Desktop Metal company) and member of *Power & Motion's* Editorial Advisory Board, said her company discovered additive manufacturing a few years ago. "At the beginning the idea was to use additive manufacturing for making tooling or prototypes for our hydraulics production." But as the company worked with it more and understood the potential of the technology, Aidro realized it could change how it went about designing its parts and adopt the principles of additive manufacturing, which is to add material only where it is needed.

As Tirelli explained, additive manufacturing offers a completely different approach from conventional manufacturing of hydraulics parts. Instead of starting with a metal block which is machined, metal powder is layered and added where necessary. This leads to the ability to create new, more optimized designs with varying geometries and even the ability to reduce part counts and component weight.

Improved Manufacturing Potential

Tirelli noted there are many advantages additive manufacturing can offer. Among them is the ability to integrate multiple parts into a single unit. Instead of assembling three or four components such as valves and manifolds, a single part can be designed which incorporates those components.

This can help with weight savings and eliminates the need for assembling as well as the potential for leakage from coupling multiple parts. It also reduces the amount of machining required for the different parts.

Improved sustainability is also possible with additive manufacturing, she said. Less material and energy are used than with conventional manufacturing methods. Because there is less material used, the amount of machining typically required is again reduced, which equates to less energy used to produce parts.

Creation of lighter-weight parts through the use of additive

manufacturing can benefit sustainability efforts, as well, particularly for the end use customer of the part. Vehicles or mobile machinery into which the lightweight parts are installed can benefit from improved fuel efficiency as use of lighter weight components helps reduce overall vehicle weight, and thus fuel use. And as mobile industries move toward further electrification, the ability to create and utilize lightweight components will be particularly beneficial to compensate for the heavier weight of other components like batteries and ensure desired efficiency gains are achieved.

To help improve sustainability on the design side, PolySpectra—a company developing advanced photopolymers for additive manufacturing—has created an augmented reality (AR) tool which can help prove out designs before creating them. This helps to reduce the amount of material that would be used for a prototype that may just then get thrown away.

"There is so much 3D printing that happens just to visualize how a part is going to [look and feel]," explained Raymond Weitekamp, founder of PolySpectra. No matter how good a person is with CAD and evaluating all possible angles and dimensions of a part, it will still wind up being printed then possibly thrown away because the shape was not what originally thought.

PolySpectra's free, web-based tool allows users to upload their STL files—the standard file type for 3D printing—to get an instant AR preview of their design. Once uploaded, the AR rendering can be moved via the computer's cursor to see how it will look from a variety of angles. A QR code allows files to be viewed on mobile phones for further ease of use. With this tool, design teams can evaluate what Weitekamp referred to as a massless prototype. Although it cannot be tested in the same manner as a physical prototype, it allows evaluation of designs at an earlier stage and the ability to make modifications before printing, which reduces material waste and printing time.

While the rendering in the AR tool may not be perfect or look exactly the same as it would in real life, said Weitekamp, it allows fast iterations of designs. "You could change the design and reload the preview every few seconds if you needed to in that phase," he said, which could benefit the development process.

He noted that many times what may seem like a good design in CAD once 3D printed turns out not to be. By using the AR tool, designs can be better proved out without wasting material, time or fully printed parts.

As AR technology continues to advance, so too will the possibilities for quickly evaluating and modifying designs. "What I think is really exciting about this idea of massless manufacturing or prototyping is you can still have [customization and options] with a dramatically lower carbon footprint," said Weitekamp.

Digital and Supply Chain Opportunities

Digitalization of the manufacturing process is another advantage additive manufacturing can provide. Tools like PolySpectra's, for instance, can enable digital files to be easily viewed and shared.

"One of the visions of 3D printing is to go towards what I would call distributed digital manufacturing, but one version of that some people call the virtual warehouse," said Weitekamp.

Instead of having a warehouse full of components which need to be kept track of, companies could have a database of files. When parts are needed, the appropriate files are found and 3D printed.

This could greatly save on warehousing space as well as time spent tracking the whereabouts of parts. It could also aid supply chains by minimizing the number of parts a company ships as it could 3D print them instead.

Tirelli also noted the benefit of additive manufacturing for spare parts production. "With additive manufacturing, we have the possibility to create a digital inventory. So instead of having a physical part in inventory and keeping it for maybe 20 years,

