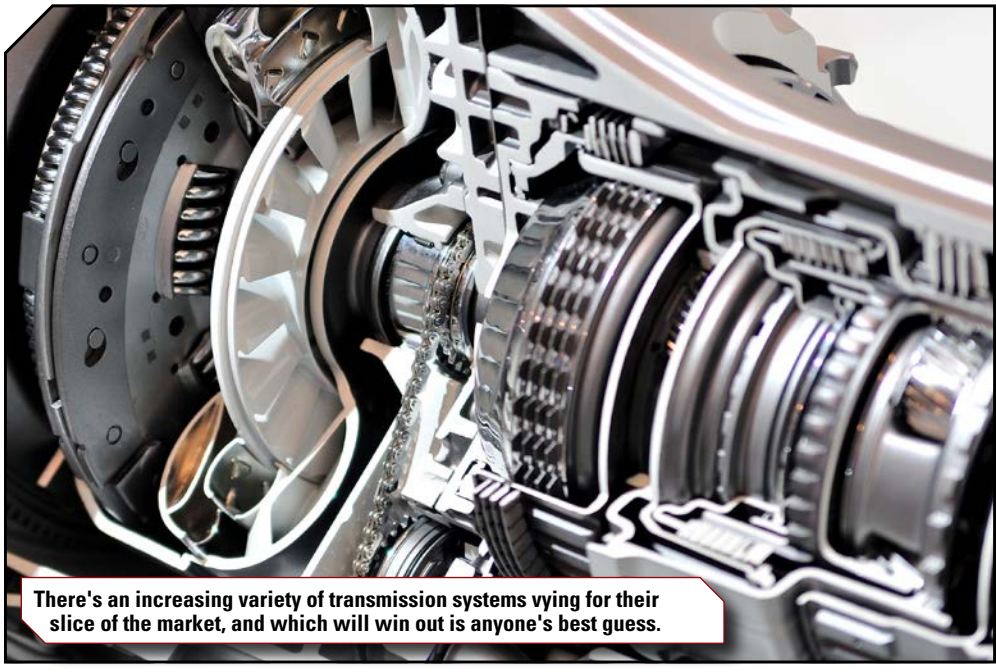
Transmission Throwdown

Which transmission system will come out on top is a hot topic in the automotive community. With multiple transmission-centric conferences on the horizon, there will be plenty of debate, but how much will the answer actually affect gear manufacturers, and when?

Alex Cannella, Associate Editor



There's an increasing variety of transmission systems vying for their slice of the market, and which will win out is anyone's best guess.

It's transmission season here at Gear Technology. CTI Symposium USA is right around the corner, and across the pond, the International VDI Congress "Drivetrain for Vehicles" is coming up in July. Both conferences are entirely focused on one topic: automotive transmissions, and that means it's on our minds, too. CTI will feature over 70 presentations, while VDI will have over 80 lectures from 12 different relevant fields. Both conferences have a heavy focus on educating attendees on the technical aspects of what's going on with autos transmissions today and what's right around the corner tomorrow, and between the two, there's going to be a lot of intellectual discourse to digest over the coming months.

Starting closer to home, CTI will feature a number of leading experts in the field of transmission technology, including plenary speakers ranging from representatives of major automotive companies such as Ford, GM, BMW and Nissan to the Environmental Protection Agency. As one might expect, plenary speakers will be spending plenty of time discussing the future of the automotive powertrain, but topics covered everything from quality management to technology compliance.

The rest of CTI's many seminars fall into a few different categories. A few main points of attention are hybrids and continuously variable transmissions (CVT), but there will also be plenty of discussion about new transmission concepts andindividual transmission components. Other topics include safety and cyber security, design methods and tools, control systems, launching devices and commercial vehicles. Alongside the conference, over 70 exhibitors will be in attendance to show off the latest advances in automotive transmissions.

Preceding the CTI conference will be a two-day seminar on the basics of automotive transmissions and the Agile in Automotive USA Conference. The Agile Conference focuses specifically on the agile design philosophy and how to utilize its tenets and best practices when developing transmission technology. After two years of success in Europe, the conference will make its U.S. debut alongside CTI.

The seminar, meanwhile, highlights different conventional and electrified drive concepts common in the industry today, different design layouts for transmission systems and drivetrain management. The seminar will be presented by the Institute of Automotive Engineering at the Technical University of Braunschweig, the head of which, Dr. Ferit Küçükay, is also the chairman of CTI Symposium Berlin, which you can catch in December.

If you can't make it out to CTI USA and don't mind the trip out to Bonn, Germany, you can get another in-depth look at the future of automotive transmissions by attending VDI in July. In addition to the 80 plus presentations planned for the show, over 1,500 international participants and 100 exhibitors are expected to converge on VDI, offering plenty of opportunities to mingle and network with other industry thinkers and fellow company leaders.

VDI's "Drivetrain for Vehicles" will be accompanied by two other VDI-run conferences: "Control Solutions for Transmissions" and "Transmissions in Commercial Vehicles." "Control Solutions for Transmissions" will focus on different control fields ranging from sensors to interfaces, along with the benefits that stem from using those solu-

tions. "Transmissions in Commercial Vehicles," as one might expect from the name, will specifically discuss innovations, trends and operating strategies pertaining specifically to commercial vehicles.

Lectures will largely be grouped by transmission type, with discussions being held on almost every transmission, including hybrid, automatic, CVT, manual and dual clutch transmissions. There will be a particular focus on hybrid transmissions, with one lecture track even focused specifically on the 48V hybrid transmission, which according to Küçükay, will become increasingly common in the industry in the future.

"Due to the legislative CO_2 target emissions and high cost for hybridization, 48V mild hybrids will become a relevant technology within the next years," Küçükay said. "With electrical powers up to 20 kW hybrid functions such as recuperation, boosting or coasting offer a fuel consumption reduction of about 20 percent within legal cycles. Another benefit of a 48V system is the coverage and integration of auxiliaries with a high power demand such as e-booster or electric catalyzer. Some manufacturers of premium vehicles already introduced 48V systems for series applications. In the near future 48V systems will be introduced for smaller vehicle segments such as the C-segment."

Other topics will include virtual engineering, NVH and discussing individual components such as gears, couplings and clutches. Meanwhile, plenary lectures will focus on the higher level questions in the industry, taking a look at concepts such as autonomous driving, geared transmissions and how they relate to fully electrified drivetrains, and how to get by in an industry that's in flux.

And the industry certainly is in flux. Technology is advancing at a breakneck pace, and some automotive experts are saying that even technologies that are difficult to imagine today such as autonomously driving cars will be entering the market and becoming more commonplace within the next decade. With so many new advancements in the industry, the automotive market has a number of big questions it needs to work out, with new technologies clashing with old, established systems for market dominance. In another decade, the automotive industry could look completely different from how it does now.

The biggest question being asked in the industry right now (and one you'll definitely hear at VDI) is a simple one: which transmission?

That may sound like an obvious centerpiece of discussion for a transmission-oriented conference, but the debate is one the entire industry, not just transmission specialists, is watching. The automotive market is being divided between an increasingly diverse array of transmission systems, and the question of which will eventually become the transmission of choice is one that nobody seems to be able to agree on.

And not only is the market divided by an increasing number of transmission types, it's also fractured regionally. Depending on which continent you're in, favored transmission types and their market shares completely vary. North America, for example, is dominated by automatic transmissions. According to a 2014 article put together by Wajih Hossenally and Chris Guile of IHS

Automotive and run in *CTI Mag*, 75 percent of the North American market is controlled by automatic transmissions, with CVT being the second most prevalent transmission type at 12 percent and manual only holding 8 percent.

But go to Europe, South America or South Asia, and the manual transmission reigns supreme, making up 65 percent, 81 percent and 72 percent of their cars produced respectively. Go to Japan and Korea, and you'll find the highest concentration of CVT transmissions, representing 30 percent of all vehicle production in the region, alongside 40 percent automatic transmission and 19 percent manual. If you're focusing on individual markets like North America, there are some pretty clear preferences, but marketing oneself globally is a more ambiguous proposition.

Add in DCT transmissions, which are also vying to break into the market, alongside the advent of every flavor of hybrids (both modular and dedicated) and fully electric cars, and there are a lot of different transmission designs with no one-size-fits-all solution to sweep the market in sight.

But for the average gear manufacturer, the great transmission debate, and any eventual answers the industry might come to, is of less concern than one might expect. No matter the transmission, cars will still need gears. And while, yes, different transmission types require different numbers of gears and that could affect market demand, it's highly unlikely that the industry's need for gears will be going anywhere. The only contender that could possibly derail the geared transmission system is a fully electric drive that skips the transmission system altogether, but according to Reishauer's Marketing Manager, Walter Graf, even a fully electric system could arguably require gears to operate.

"The car manufacturers have a whole range — hybrids, petrol, ICE drives, maybe even hydrogen in the future," Graf said. "But all of those need gears to some extent. There are electric drives that don't need gears. The question will be in the future: what percentage will they have amongst electric driven cars? The answer I can't give you. You find when you check the literature, some people say 'yes, they will need gears,' some say 'yes, they will need gears, but three-speed, two-speed is enough,' and some will say 'no, one-speed drives is good enough,' and I think the jury is still out on that one."

While Graf is hesitant to pass judgement, Küçükay is more optimistic and notes that regardless of whether or not electric drives utilize gears, transmissions won't be going anywhere anytime soon.

"Transmissions as we know them today will only vanish when the internal combustion engine is not necessary anymore, meaning close to 100 percent of the vehicles are pure electric," Küçükay said. "This change will not take place in a foreseeable future and even for pure electric vehicles, transmissions with two and three speeds become relevant. They offer a cost-effective alternative and are needed in higher vehicle classes to ensure launch and climbing capability, while maintaining performance as well as maximum velocity requirements."

"Is it really a big hoopla and should [gear manufacturers] really be worried about it? I would say no," Dennis Beauchesne, general manager at ECM, said. "I would say that the types of gears we're going to see might be different. We're seeing a lot more powder metal gears coming out...and of course, there's always 3D additive manufacturing gears, as well, that are coming out, but I don't see those taking effect for many of the gear manufacturers for 10 years."

Even if electric drives do become the de facto standard, and even if they do so without using any gears, it won't happen for quite some time. According to some predictions put together by PricewaterhouseCoopers last year, electric cars will only make up 35 percent of the North American market in 2028. PwC expects hybrids to be the dominant car of choice and make up 51 percent of the market, and those are guaranteed to still require gears.

So while, yes, electric drives have the potential to work with just a single speed gearbox, it's difficult to envision a nightmare scenario in which electric drives conquer the entire market and put all us gear guys out of work. The advent of hybrid and electric cars doesn't necessarily have to be looked at as a net loss, either. Graf also notes that the same mentality that is a driving force behind the switch to hybrid and electric cars is also currently benefiting the gear grinding industry.

"Because of energy consciousness, the gears have to be more accurate, so we figure that gear grinding will become more important than it is now," Graf said. "It's already very important; all the American manufacturers now grind their gears. That wasn't the case maybe 10, 15 years ago."

Beauchesne's own take on the industry's future is that he believes CVT transmissions will start muscling in on 5- and 6-speed transmissions for smaller gas motors within the next few years. The 8-10-speed transmissions will stick

ECM's FLEX heat treating system. ECM will be the only heat treatment exhibitor at the CTI Symposium in May.

around far longer, but they'll also be in direct competition with hybrids and electrics and may ultimately be replaced.

"Obviously the trend is to get away from gas engines," Beauchesne said. "So the higher torque transmissions won't be needed as much, and if we get into more self-driven cars, then there's even less need for the higher torque transmissions."

Unfortunately, there's little chance of any new premium 11- or 12-speed transmissions becoming commercially widespread to drive up gear demand. While current transmissions will be around for many years to come, one thing the automotive industry has mostly come to a consensus on is that the diminishing returns from upping the number of gears in a transmission have officially crossed the threshold of becoming cost prohibitive.

"There is no logical reason or tangible benefit for increasing the number of speeds for conventional powertrains beyond 10-speeds for passenger car and light duty applications," Dr. Hamid Vahabzadeh, chairman of CTI Symposium USA, said.

Another batch of automatic transmission pinion gears is prepped for heat treatment at an ECM facility.

"I think if you made a gearbox with more than 10 gears, the gains would be minimal and the complexity to manufacture and the cost would be prohibitive," Graf said.

Under Beauchesne's view of the future, the transmissions that are the gear manufacturing industry's current cash cow will one day become obsolete, as most technology eventually does, and for some, that could be an intimidating prospect to consider. But as Graf also highlighted, that eventual day is a distant

Over the past few decades, Reishauer has noticed gear grinding consistently continue to become more relevant, and according to Graf, that trend will continue.

one, and the technology that will take over will be almost as hungry for gears as the technology today.

The other big shift in the auto industry, the one towards automated driving, isn't setting off any alarm bells for gear manufacturers, either. The idea of self-driving cars is currently capturing the industry's attention, and while it's a fascinating trend to follow, having a computer behind the wheel instead of a person isn't likely to affect the gears side of the industry too deeply.

While gear manufacturing in the automotive industry looks stable, gear manufacturers should still endeavor to pay attention to how the industry develops. With a strong market that looks like it will continue to prosper and no major technology dilemmas on the horizon, it's true that gear manufacturers in the automotive industry don't have to worry about where to get their daily bread. But while there's no reason to start losing sleep over whether electric cars will conquer the market or not, manufacturers will still need to pay attention to the needs of up-and coming technologies and adjust their manufacturing capabilities to match what that new tech requires to remain competitive. According to Beauchesne, so long as gear manufacturers keep up with the times, there will be work no matter which way the tide flows in the larger debates wracking the industry.

"The net result, I think, as long as you're following what's necessary in CVT transmissions and hybrids and electric transmissions, there will still be machining and gears needed for those applications," Beauchesne said. "So net result: the number of gears being manufactured and the number of machine operations that are being done in the automotive industry will still be really high. We're not being replaced by plastic gears, or anything like nylon gears. Obviously, the shape of the gears in the transmission are going to change."

For more information:

CTI Symposium USA
Phone: +49 (0) 2 11.96 86-3000
www.transmission-symposium.com/usa

ECM USA
Phone: (262) 605-4810
www.ecm-usa.com

Reishauer AG
www.reishauer.com

VDI Wissenforum
Phone: +49 (0) 2 11.62 14-201
www.vdi-wissensforum.de/en/transmission-congress

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