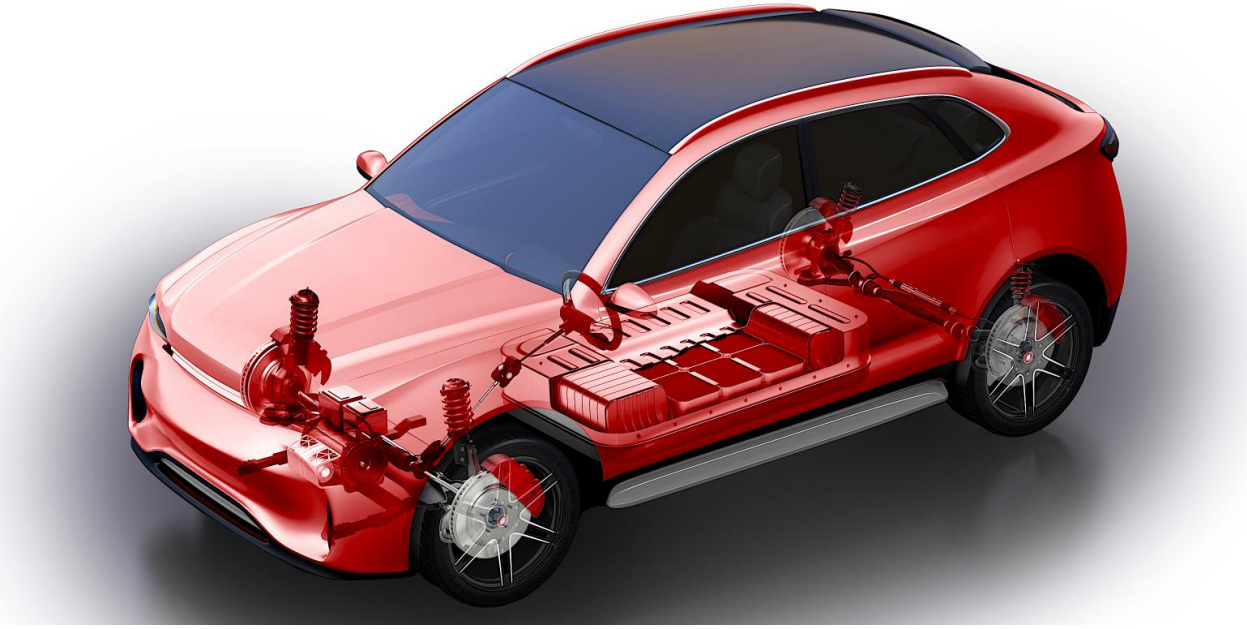
DesignNews

How to Build a Better Advanced Park Actuator to Simplify Adoption of New-Tech Transmissions



Stoneridge, Inc. has devised a Park actuator tough enough to install inside car transmissions.

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Traditional planetary automatic transmissions include a “Park” pawl, which serves as a stationary gear to hold the car securely in place when it is stopped. But the proliferation of alternative drivetrain alternatives including dual-clutch transmissions, continuously variable transmissions, and electric vehicle single-speed transmissions have complicated the solutions for putting a car into Park.

We put in a call to park module supplier Stoneridge, Inc. to hear about how this category of actuators is changing in response to these new developments in the automotive market. They provided Product Line Manager for Control Devices Actuators, Scott Skelton, to fill us in.

Design News: What are the current shortcomings of park modules and transmission actuators?

Scott Skelton: As OEMs and transmission manufacturers design the next generation of transmissions, including electric gearboxes, the gear shift system is undergoing a major disruption. And, while this transformation is prevalent across all propulsion technologies, it is especially evident in electrified vehicles where non-traditional transmission suppliers are being faced with complying with the FMVSS 114 park system requirements.

A common theme within the industry is to use externally mounted actuators to actuate the park lock function. In such a design, a linkage passes from outside to inside the transmission, and vehicles may experience leak or contamination issues. Due to the external mounting, the actuators may generate noticeable noise or vibrations. An additional shortcoming of many transmission actuators is that the speed of actuation is relatively slow, limiting the way the actuator can be utilized.

DN: How can complexity be reduced, and reliability be improved?

Scott Skelton: Stoneridge challenges accepted norms in powertrain system architecture, enabling OEMs new opportunities for design flexibility and packaging optimization to reduce component and system complexity. Our team brings vehicle, system, and component-level knowledge to each development, allowing for scalable, flexible, and powerful solutions.

For example, when a vehicle's traditional shift lever is simplified to a series of buttons or a shift dial, the cables connecting the shift lever to the transmission are eliminated.

As a result, the once purely mechanical system is replaced by an electronic system. In addition to increasing reliability, it also increases capability. This includes automated features, such as park assist and automated driving, as they require "by wire" capabilities. Additionally, vehicle

and system safety increase, as this allows the system to ensure park is engaged when the driver exits the vehicle as opposed to relying on manual driver operation.

In addition, the Park lock actuator is a critical component to the vehicle's safe operation. Stoneridge's Integrated Park Module (IPM) is an extension of the parking gear and park lock mechanism, which can result in significant forces transmitted to the actuator when the vehicle is placed into Park while in motion. The high forces require an extremely robust mechanical design, one that is more highly engineered than typically required for an external Park lock actuator.

DN: How did you overcome the technical challenges of hardening the module for installation inside the transmission?

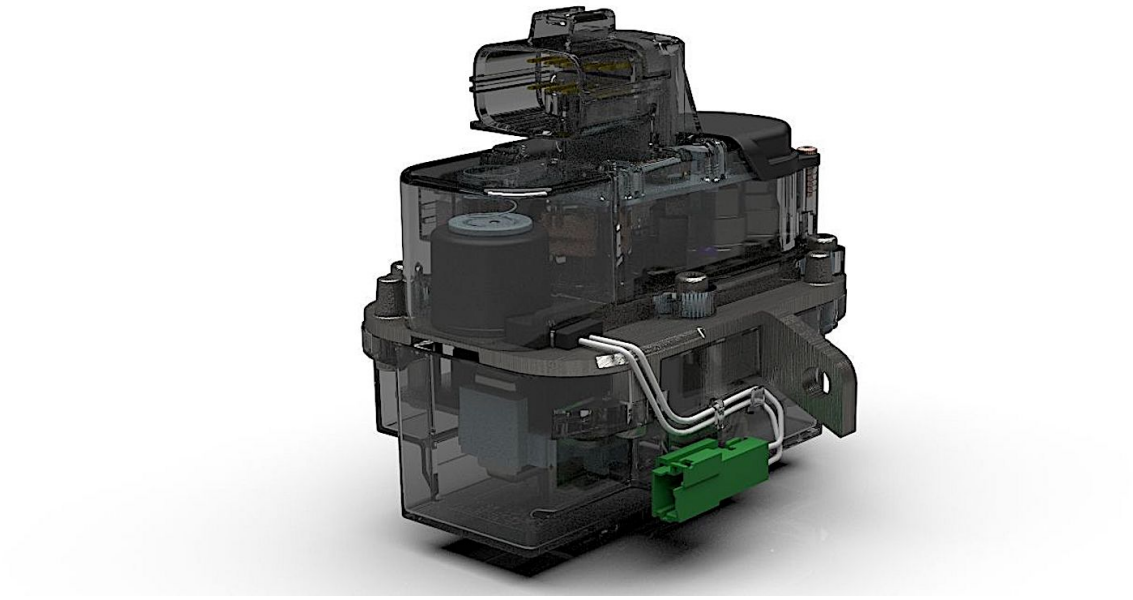
Scott Skelton: The development of Stoneridge's IPM was a major hardware and system development feat. It took the integration of high-level electronic and mechanical complexity to ensure the system performs safely and reliably while having a durability requirement to ensure the IPM will outlast the transmission.

While this is a formidable challenge, placing this system inside a transmission added another dimension of technical hurdles. As a result, the electronics and motor development were much more demanding than for an external actuator, and invention was required to address these concerns. Yet, installation inside the transmission in the presence of transmission fluid was a benefit due to the lubricating and anticorrosive nature of the fluid.

Specific to the IPM, there were four main challenge areas to address:

- Materials: Some materials, such as certain types of plastics, are not compatible with transmission fluid. Therefore, we had to specifically select grades of plastics that were compatible.
- Motor: We were not able to implement the type of motor traditionally used for this type of actuator due to the presence of transmission fluid. As a result, our engineers were tasked with finding materials and methods for delivering sufficient power while not being vulnerable to the environmental conditions present within the transmission. This resulted in a completely new and unique motor design capable of meeting the temperature, durability, and reliability requirements.
- Electronics: Like the motor, electronics are not durable in the presence of transmission fluid. Since we did not seal the actuator, we had to find a coating that would survive as a barrier between the transmission fluid and the electronics. This took a significant amount of R&D to develop and test a coating that would survive.
- Integration: Transmission actuators are often decided upon late in the development cycle. This results in them being sub-optimized around the packaging and integration requirements. By working with customers early in the development process, we've proven the ability to optimize the actuator and system capabilities.

While there was no shortage of challenges in this development, Stoneridge leveraged our deep vehicle, system, and component-level knowledge to systematically address the technical hurdles faced during development.



DN: Are there cost or serviceability implications from this solution?

Scott Skelton: Mechanical-based actuator solutions are often complex and suffer from reliability and quality issues due to their mechanical linkages. By eliminating these linkages and replacing them with a Stoneridge solution – electronic- and software-based – we're able to achieve system-level robustness and reliability benefits.

The internal nature of a product within the transmission has serviceability implications at a component level, but this improved system-level robustness and reliability is a feature difficult to achieve otherwise.

DN: What transmission suppliers or automotive OEMs have expressed interest, or which ones are you currently supplying previous products?

Scott Skelton: Stoneridge has long been at the forefront of driveline and transmission actuation technologies, delivering propulsion-agnostic systems which can be leveraged in ICE, hybrid, and electric vehicles. Through unparalleled knowledge of systems integration and powertrain architectures, we're able to design and deliver more efficient and flexible solutions.

Stoneridge is currently in production with three major OEMs for its Internal Park Module and Shift-by-Wire solutions, including for five electric vehicle platforms – three in production and two in development.
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