Levant Power

A ground-breaking active suspension system to transform the driving experience

speedgoat
real-time simulation and testing

Levant Power's multidisciplinary engineering team aims to bring to volume production a revolutionary, fully active vehicle suspension system, which makes use of advanced software and innovative energy harvesting techniques for profound performance gains.

Levant Power was founded by MIT graduates Shakeel Avadhany and Zack Anderson in 2009, initially with a new idea for energy recovery in suspension systems. Early on they recognized a need for fully active suspension, where in addition to damping, an active force can be applied to push and pull the wheels, dramatically improving the vehicle ride, handling and driving experience.

Existing systems were expensive, had high energy consumption, and were difficult to integrate into vehicles due to bulky hydraulic hoses and pumps. They realised that the technology they had could be adapted into a fully active system that would have a similar package size as a standard shock absorber. They quickly shifted their focus to developing the new product.

GenShock

The company's GenShock system is the world's first hydraulic regenerative active suspension.

GenShock shock absorber

At the heart of the system is a new type of "smart" valve - called an Activalve - which combines a hydraulic pump (a proprietary gerotor design) with an electric motor / generator, driven by integrated electronic control unit. This Activalve is used to regulate the flow of fluid in a standard hydraulic damper.

To create electrical power in regenerative modes, fluid from the damper is routed through the valve to drive the pump and generator, creating controlled damping. In the active modes, the pump is driven by electrical power to drive fluid and force the damper up or down.

Energy-Neutral Operation

The energy efficient design of the hydraulic system, coupled with software algorithms geared towards reducing energy consumption, result in energy-neutral operation over a normal drive cycle.

Advanced Control Algorithms

The GenShock system is centered around advanced software control algorithms. In order to provide high quality ride characteristics and be as energy efficient as possible, the system requires very precise and rapid control. At a low level, software algorithms solve inherent mechanical limitations of the valve in order to get maximum

performance. At a high level, wheel control and body control give the best driving experience, for example when driving into and out of corners.

The system recognizes and adapts to driver behaviour, acceleration, braking, cornering, and everyday road conditions such as potholes, bumps, frost heaves, driveways and freeway dividers.

Simulation & Testing

The company uses Simulink models to simulate the entire performance of the system - electronics, mechanics, and hydraulics. They also run vehicle level simulation using CarSim software. The output of CarSim is integrated into Simulink.

Control algorithms can be rapidly prototyped in Simulink, and then almost immediately transferred to a Speedgoat Mobile real-time target machine for testing on the vehicle with minimal overhead.

During vehicle testing, engineers can dynamically tune parameters in real-time.

The real-time target machine communicates with each GenShock over a private distributed CAN network. A connection to the vehicle's main CAN bus allows the target machine to receive information such as steering position, accelerator, braking, and GPS.

A central energy management control system (designed by Levant) is used to regulate power flow of the four units at a vehicle level. This is also on a CAN bus. Analog sensors providing additional information from the vehicle are directly read by the target machine.
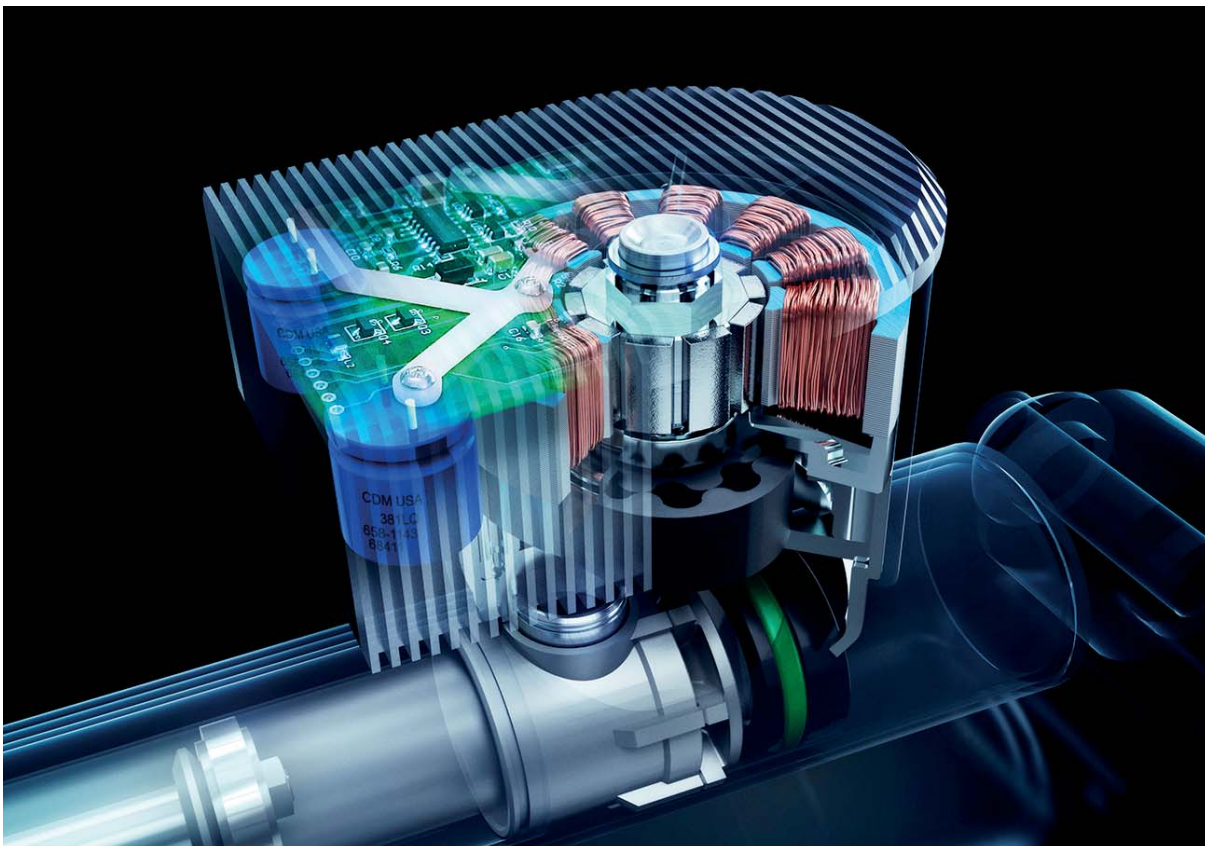
The company is now working with OEMs to bring GenShock to production.

Speedgoat's value contribution

"With limited resources as a start-up, the time to get things working is really key. Speedgoat excelled for us.", said Mr. Anderson.

Zack Anderson, Chief Operating Officer of Levant Power

Levant Power's new Activalve integrated valve technology

Levant Power

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Speedgoat products used

- Mobile real-time target machine
- IO101 analog I/O module
- IO601 intelligent CAN I/O module

MathWorks software used

- MATLAB®
- Simulink®
- MATLAB Coder™
- Simulink Coder™
- Simulink Real-Time™

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