Marelli Pro and Elite Platforms

Insight Pack 3
Ride Dynamics

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ABSTRACT

As automakers shift to software-driven and electric vehicles with advanced features, Marelli empowers engineering teams to bring pioneering, cost-contained innovations into series production by leveraging modular, high-tech concepts.

Building on pre-developed and validated technologies, Marelli's Pro and Elite platforms facilitate rapid roll-out across trims and model lines, providing a comprehensive portfolio of modular hardware and software features and solutions spanning Lighting, Electronics, Displays, Suspension and Propulsion.

Leveraging the purpose-built foundations of the Lean platform, the Pro platform introduces upscaled innovation for mainstream models, while the Elite platform delivers cutting-edge performance and design freedom for premium and luxury vehicles.

Our comprehensive portfolio papers detail the distinct advantages of each Marelli Pro and Elite platform—Pro and EliteLight, Pro and EliteZone, Pro and EliteCore, ProConnect, ProDisplay, Pro and EliteHorizon, EliteRide, and ProEnergy.

This third insight pack provides an in-depth focus on EliteRide.

HARDWARE PLATFORMS INTRODUCTION

Aligning innovation with market demands is central to Marelli's strategy. Today, our modular hardware platforms underpin this strategic model, enabling automakers to rapidly address specific requirements across tiered market segments with high growth, high-market share products.

Leveraging deep cross-domain expertise to deliver integrated or standalone solutions at speed, Marelli's scalable platforms streamline development, optimize investment and support more sustainable vehicle architectures.

Developed to offer greater modularity, each platform targets up to 70% reuse of subsystems and components, significantly compressing R&D timelines and mitigating the risks of clean-sheet designs, while accelerating time to market.

Marelli rapidly advances concepts to the minimum viable product stage and co-engineers with OEMs to introduce future-proof features and functionalities.

As a result, automakers gain a technological edge and the agility to act as first movers, seizing early market share.

In addition to hardware, Marelli has developed software platforms that include standalone, decoupled software applications, as well as software-enabled tools and features that drive Software-Defined Vehicles (SDVs).

This integrated approach further fosters co-creation opportunities with automakers and expands personalization options for buyers.

Tailored to fulfill the diverse needs of different vehicle segments and buyers, Marelli's hardware platforms deliver significant competitive advantages, with scalability, cost efficiency, flexibility and reduced timeframes that help automakers get to market fast.

Platform-powered innovation: Accelerating your time to market

A TIERED SYSTEM: LEAN, PRO AND ELITE

Marelli's hardware platforms are structured around three scalable tiers – Lean, Pro and Elite. Each is designed to offer broad coverage across market segments while providing in-depth capabilities across various vehicle systems. With an emphasis on scalability, this model offers flexible, pre-engineered components that allow automakers to efficiently leverage technology without starting from scratch.

Lean is engineered for base trims, entry-level vehicles and value-driven brands. Its fit-for-purpose technology focuses on affordability, sustainability and speed. Lean emphasizes component simplification, reduced development time and design for manufacturing.

Pro puts the focus firmly on scalability. It is Marelli's most versatile and adaptable platform. It targets electric vehicles and mainstream vehicles that offer unique features beyond their class. This approach includes up-scaling well-established innovations from our Lean platform, or value-optimizing high-end features developed for premium vehicles. With the broadest range of customization and feature options, Pro is engineered to meet diverse consumer preferences and budgets across a wide array of vehicle segments.

Elite represents the pinnacle of Marelli innovation. A cycle of continuous investment and development keeps Marelli at the forefront of technological advancement, delivering industry-first products that set new benchmarks. As a result, Elite combines sophisticated features and high-content technology to meet the demands of tech-savvy end users and the most premium vehicle brands in the market.

Pro and Elite platform

Marelli's Pro and Elite platforms introduce advanced levels of feature sophistication and performance. Co-created with OEMs for mainstream models, EVs, and luxury lines, they balance next-generation functionality with targeted efficiency across components, wiring, energy management, manufacturing, and assembly.

Our Pro platform targets the point where feature sophistication, software content, and system integration begin to exceed entry-level architectures, frequently delivering innovative alternatives to state-of-the-art technology, offering much of their performance at a greatly reduced cost.

Our Elite platform pivotally balances groundbreaking innovation with a made-for-manufacturing mindset. Whether through Marelli-owned tooling, plug-and-play compatibility with existing vehicle architectures, or simplified assembly and validation processes, Elite platform solutions are engineered from the outset for series-production viability.

Each platform is founded on homologation-ready technology and remains highly adaptable to individual vehicle programs. Crucially, Pro and Elite platform technologies can be scaled and combined according to program needs, giving automakers the freedom to deploy advanced solutions at the pace and level best suited to each vehicle line.

Key outcomes include:

- More sophisticated features with a simplified architecture
- Faster time to market from pre-developed, production-mature foundations
- Flexibility to adapt to program-specific design, packaging and performance requirements
- Reduced manufacturing and assembly effort through consolidation of components, ECUs, modules and wiring
- Scalable, software-defined capability with Over-the-Air (OTA) upgrades
- Improved efficiency and sustainability through intelligent system design
- Architectural capacity to evolve functionality without major re-design
- Production-ready innovation – including plug-and-play compatibility, Marelli-owned tooling and homologation validation

THE PRO AND ELITE PLATFORM PORTFOLIO (Insight pack 3)

EliteRide

Marelli's EliteRide portfolio sets the benchmark in fully active suspension systems, spearheading the automotive shift fueled by smarter, more sustainable expectations and accelerated by electrification.

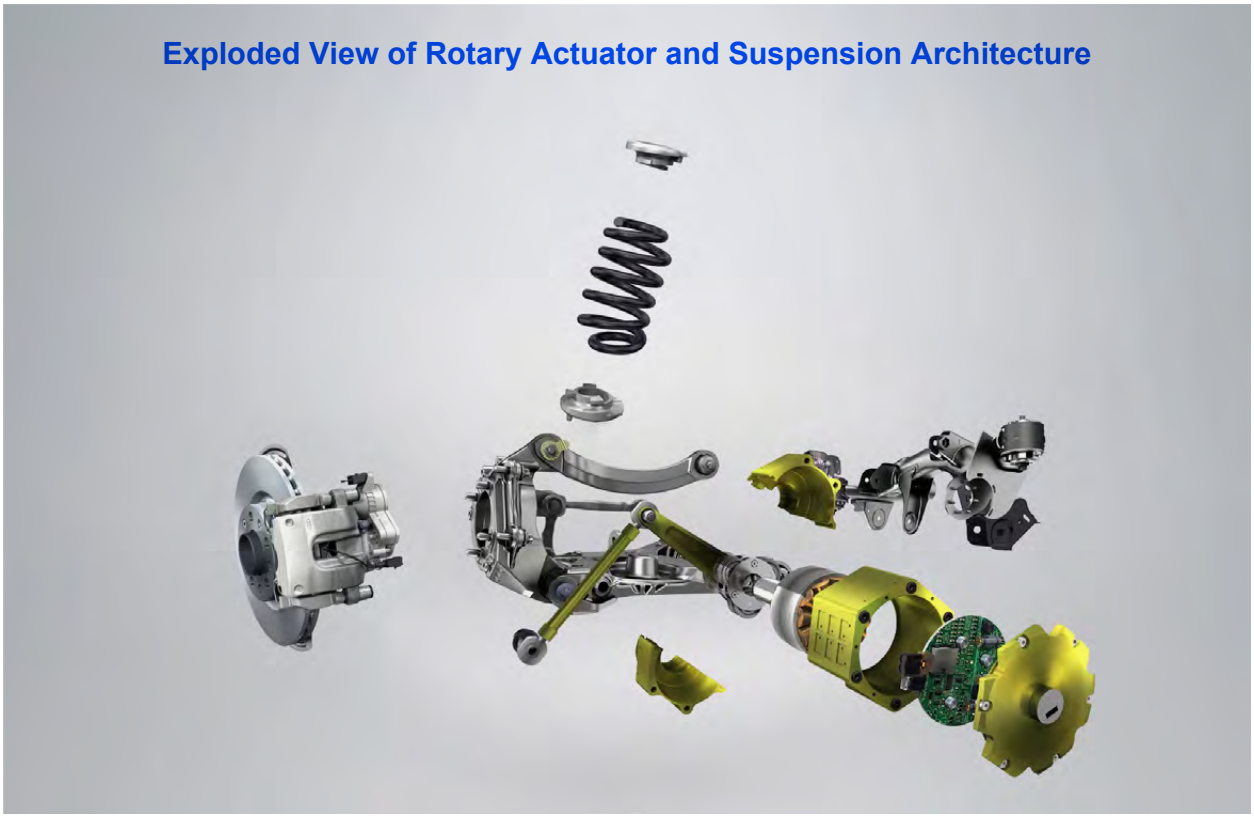
Enabled by centralized Software-Defined Vehicle (SDV) control, and predictive AI algorithms, EliteRide brings together Marelli's pioneering Fully Active Electromechanical Suspension and Fully Active Electrohydraulic Suspension to adjust chassis performance in real-time for superior ride comfort, handling, and safety.

Achieving up to 80% energy efficiency, EliteRide demonstrates Marelli's continuous commitment to industry-leading innovation.

Fully Active Electromechanical Suspension

Marelli is first to develop oil-free Fully Active Electromechanical Suspension, an innovative solution designed for superior driving comfort and control across a wide range of vehicle segments. The technology won a 2025 Automotive News PACEpilot Award, and received a "Commendable" honor at the 2023 Digital Engineering Awards. Replacing traditional shock absorbers with one electromechanical rotary actuator per corner, the advanced system provides exceptional control of vertical dynamics, brings new freedom in vehicle design, and offers high efficiency of 80% with only a minimal weight increase over a conventional shock absorber.

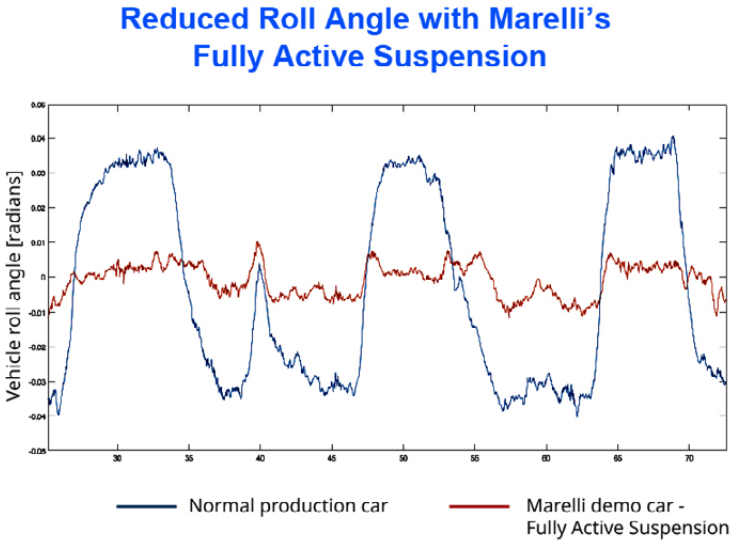
Powered by a 48 V battery – and engineered for future compatibility with 400-800 V vehicle architectures – each smart rotary actuator comprises a brushless motor and high-ratio epicycloid reduction gear connected to the suspension arm via a push rod. Suspension stroke is therefore governed by motor rotation.



Data from accelerometers, stroke sensors mounted on the suspension, and the vehicle network – including brake pressure, vehicle speed, gear selection, accelerator position and steering angle – is processed in just five milliseconds by the control unit. Smart algorithms subsequently calculate the optimal stroke target for each actuator, and the brushless motor acts on the suspension spring in as little as three milliseconds when activated by its dedicated inverter.

The result is damping characteristics optimized for every road surface and driving situation, generated either reactively or predictively to minimize roll, pitch, yaw and vibration, while maximizing tire contact patch, providing a true “magic carpet” experience. This enhances in-cabin comfort and helps reduce motion sickness during activities such as reading, using a laptop and watching videos.

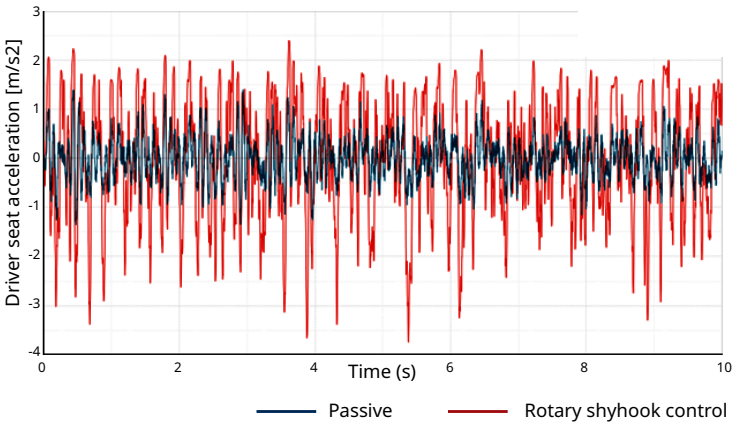
While the system power theoretically enables Fully Active Electromechanical Suspension to introduce negative forces, it is typically calibrated for zero pitch or roll angle during normal driving, while maintaining natural handling responses in more dynamic scenarios.



A vehicle equipped with Fully Active Electromechanical Suspension can maintain 0° roll angle up to 0.5 g on a 45 m radius roundabout at 40 km/h – compared with 2.1° for vehicles with passive or semi-active shock absorbers – and peaks at 1.7° at 0.87 g, less than half the roll of conventional systems.

In side-by-side tests with medium-class SUVs equipped with semi-active shock absorbers and Fully Active Electromechanical Suspension, the fully active technology reduced peak-to-peak body acceleration by 46%. At 70 km/h on a typical B-road, it also reduced the Root Mean Square (RMS) vertical acceleration at the driver's seat by 55%.

Minimized Driver Seat Acceleration for Enhanced In-Cabin Comfort



Test profile: medium-class SUV, B road, 70 km/h (Estimated)

Passive safety is also enhanced – the actuators can place the suspension in an optimized state if an impact is unavoidable, even when the vehicle is stationary. This minimizes the risk of rollover should the vehicle leave the road.

Weighing approximately 6.8 kg, each actuator is 50% lighter than an electrohydraulic alternative and is mounted low and inboard on the vehicle body. This introduces new freedom in vehicle design, reduces the center of gravity, and removes requirements for hydraulically interlinked circuits and anti-roll bars.

The motor is also mounted on the vehicle body, rather than inside the fully active shock absorber – lowering unsprung mass and removing requirements for liquid cooling.

Lightweight, Compact, Fits Multiple Suspension Architectures

This oil-free technology can also provide all functionality at almost zero “energy cost” for the vehicle. Energy harvesting on the suspension rebound stroke delivers a high efficiency rate of 80%, with up to 11 W per corner regenerated at 70 km/h on a typical B-road.

With ride and handling characteristics largely defined by software, Fully Active Electromechanical Suspension reduces hardware changes between model lines, supports development through Digital Twin simulation, and can be updated over-the-air to expand comfort, handling and safety capabilities over time. The simplified chassis architecture also opens opportunities to optimize vehicle design in early development phases, potentially streamlining assembly processes.

Further benefits include integration with ADAS systems to level the car body for collision mitigation, and energy harvesting for system efficiency up to 40%.

Need to know

- Tri-phase permanent magnet electric motor
- Epicycloid reduction gear with leverage mechanism
- Fully oil free
- Compatible with 48 V power electronics
- New freedom in vehicle design
- 80% energy efficiency
- 6.8 kg weight
- 50% lighter than Fully Active Electrohydraulic Suspension
- 55% reduction in RMS driver-seat vertical acceleration*
- 46% reduction in peak-to-peak body acceleration**
- 0° body roll to 0.5 g
- <3 ms actuation time

* Compared with a medium-class SUV equipped with passive shock absorbers
** Compared with a medium-class SUV equipped with semi-active shock absorbers

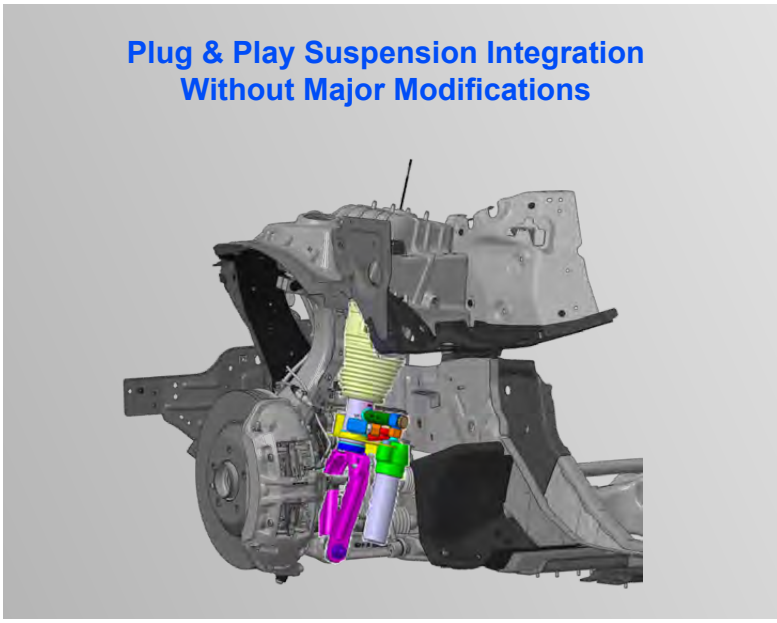
Fully Active Electrohydraulic Suspension

Marelli's Fully Active Electrohydraulic Suspension enables OEMs to transition effortlessly to next-generation chassis technology while delivering driving dynamics and comfort comparable to Fully Active Electromechanical Suspension systems.

A true plug-and-play solution for existing vehicle architectures, it replaces conventional shock absorbers of similar geometry, simplifying integration with both coil and pneumatic springs.

It also avoids modifications to suspension arms or anti-roll bar mounting points.

Each actuator body incorporates a piston with an electronically controlled dual-stage valve and integrated gas accumulator. A compact hydraulic pump, driven by a 48 V tri-phase permanent magnet electric motor, generates actuation pressure.



The control system processes inputs from one suspension-stroke sensor per damper, a gyroscopic accelerometer, and Controller Area Network (CAN) data for brake pressure, vehicle speed, gear selection, accelerator position, and steering angle to calculate optimal actuator response. Actuation occurs in under 25 ms, at pressures up to 120 bar, and applies forces up to 3000 N per corner to counter body movements and minimize vibration.

Compared with simulation results for passive and semi-active shock absorbers, RMS vertical acceleration is reduced 45% on a rough road at 70 km/h, with peak-to-peak vertical acceleration down 30-40% at the same speed. Lateral performance matches that of Fully Active Electromechanical Suspension, maintaining 0° of static roll up to 0.5 g, and less than 50% of the static roll angle of passive and semi-active shock absorbers beyond that threshold.

Fully Active Electrohydraulic Suspension: Front and Rear Actuators

Need to know

- Plug-and-play for existing suspension architectures
- Hydraulic actuator with gas accumulator
- Dual-stage electronic valve
- Hydraulic motor pump with 156 l/min
- Tri-phase permanent magnet electric motor
- Compatible with 48 V power electronics
- 120 bar pressure
- Customizable motor pump bracket design and pipe connection
- 13 kg weight
- 40% reduction in RMS vertical acceleration *
- 30-40% reduction in peak-to-peak acceleration *
- 0° body roll to 0.5 g
- Actuation <25 ms

* Simulation results comparing semi-active technology and Fully Active Electrohydraulic Suspension

Innovation @Speed.

At Marelli, we believe speed is the new currency in automotive. In a world defined by shifting consumer expectations, rapid tech evolution, and intense competition, getting to market faster isn't just an advantage — it's essential.

Marelli empowers automakers to move with speed and purpose. As a trusted technology partner, we offer scalable platforms, software-defined vehicle enablement tools, production-ready solutions, and fast innovation cycles designed to shorten development timelines and unlock early market opportunities.

We enable speed-to-market in four distinct ways:

- **Platform Products** – Tiered, modular hardware and software solutions engineered for speed, scalability, and smart customization.
- **Software-Defined Vehicle Enablement Tools** – Supporting future-focused E/E architectures with flexible hardware, decoupled software, and cloud virtualization tools that accelerate development.
- **Ready-to-Offer Technologies** – Proven, production-ready innovations built for immediate integration and impact.
- **Minimum Viable Product Innovation** – From concept to working prototype in as little as 90 days, our agile innovation process enables co-creation with automakers for rapid product development.

This paper illustrates how Marelli's Pro and Elite platform products accelerate time to market through modular, cost-effective design, pre-validated components, and streamlined integration.