

Revised 4/6/17 – Name Change from Levant Power to ClearMotion



***ClearMotion***



# Contents

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- ▶ **Product Overview**
- Technical Deep Dive

# Video Demonstration: Super-Active Ride Control

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## Constant Tradeoff: Ride vs. Handling

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*Athletic Handling*

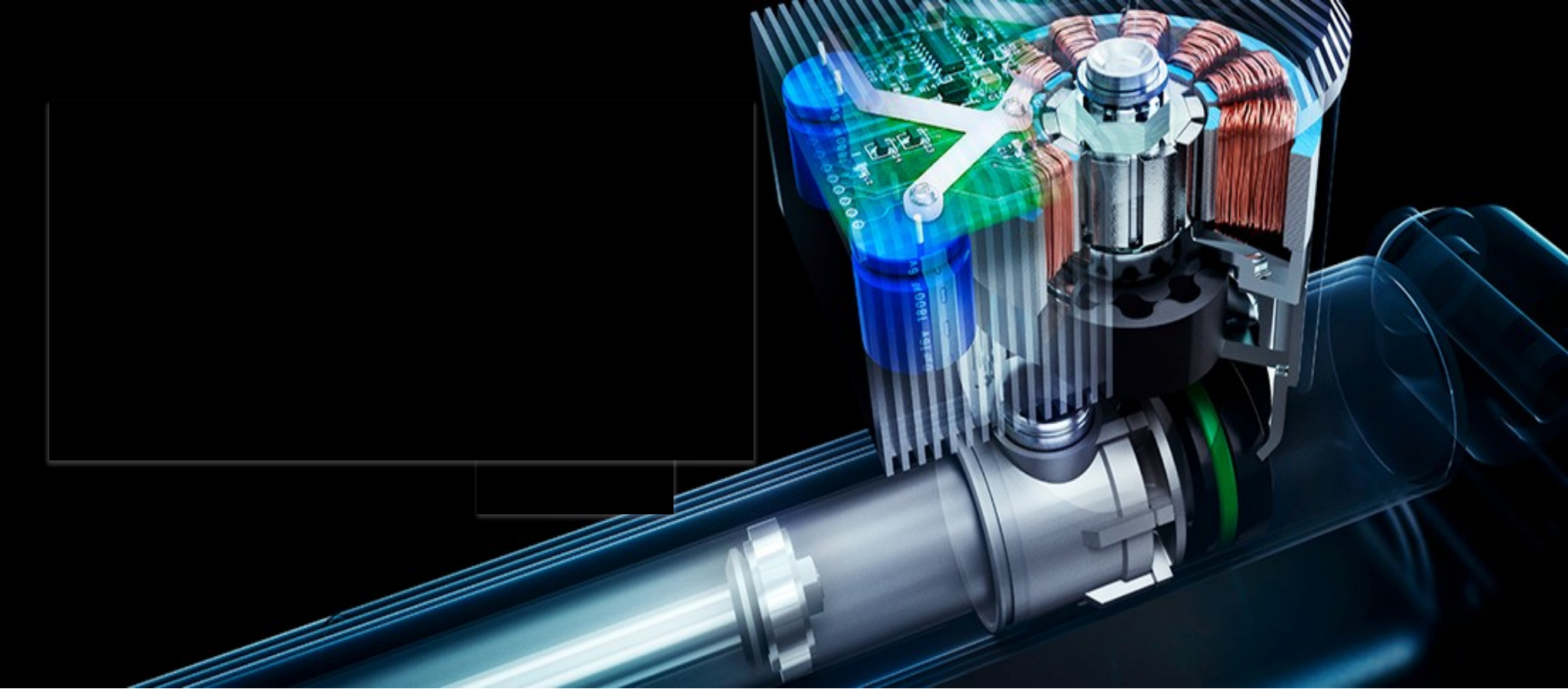
*Silky Comfort*



*Two cars in one: Industry pursuit over 30 years, **no solution yet.***

# Novel Approach: Local electrohydraulics and controls

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Product Overview

## **Technical Deep Dive**



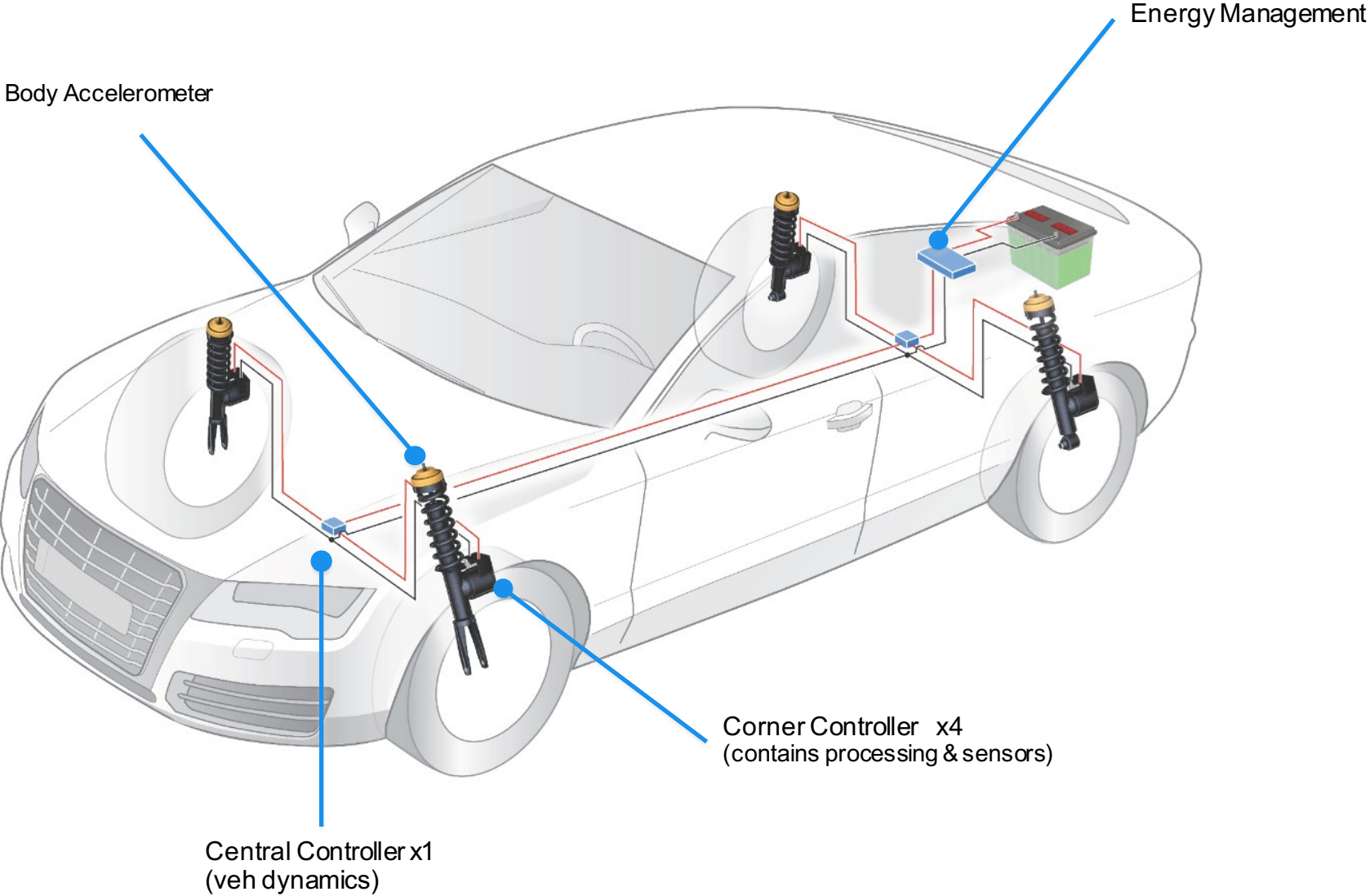
System Architecture

Deconstruction of a bump

Performance & Tuning

Embedded Software Architecture

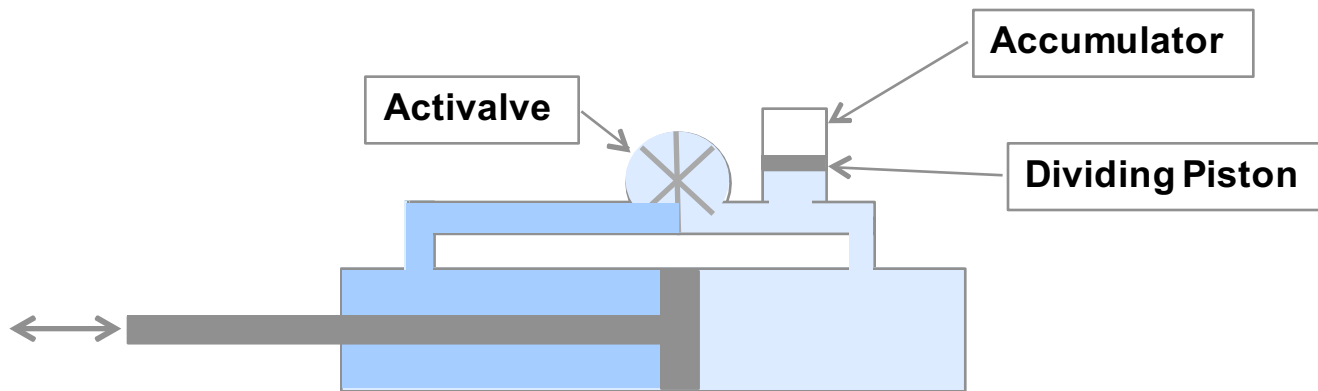
# GenShock System Architecture



# Hydraulic Principle

## Passive Quadrants (I and III)

- ! Oil Flow through the valve in both directions
- ! Volume of the piston rod is compensated by the gas accumulator
- ! Gas pressure supports rebound forces
- ! Hydraulic pump acts like a variable damping valve for oil flow in extension and compression

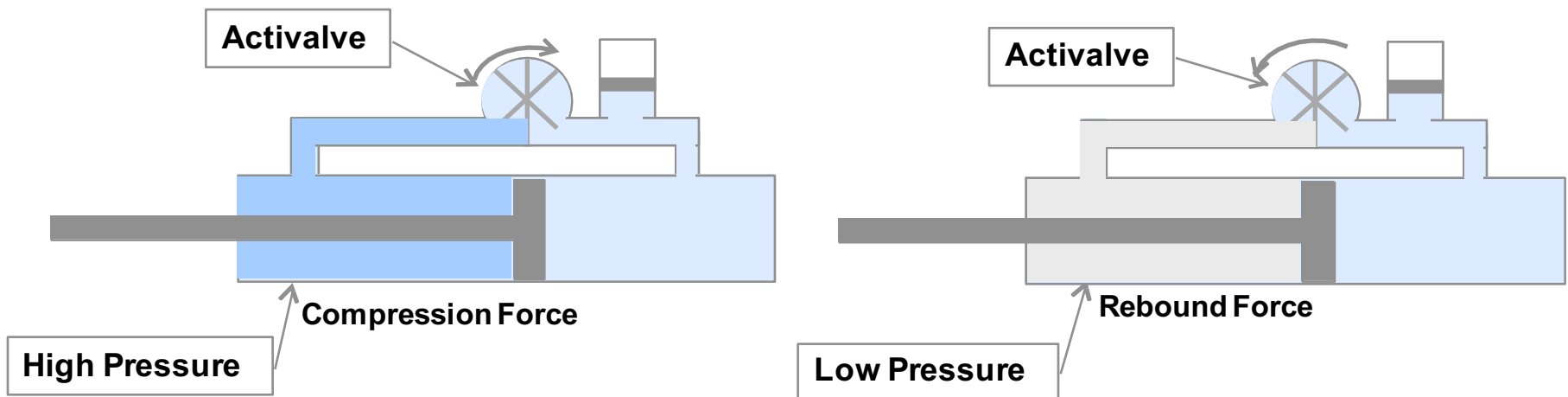




# Hydraulic Principle (cont.)

## Active Quadrants (II and IV)

- ! Active valve is able to supply oil volume independent of the stroke
- ! Thus, it can increase or decrease pressure acting on the piston



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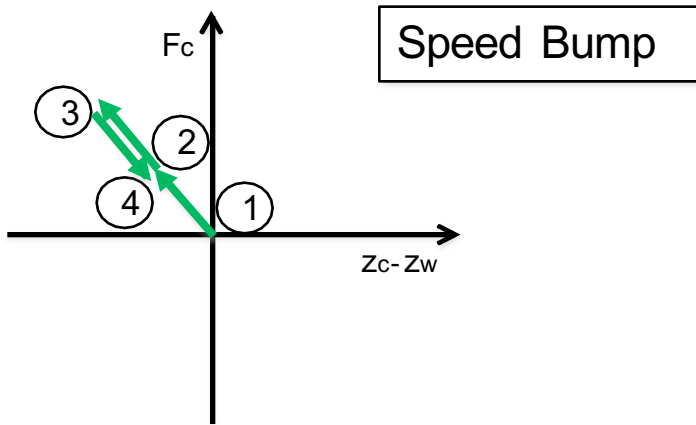
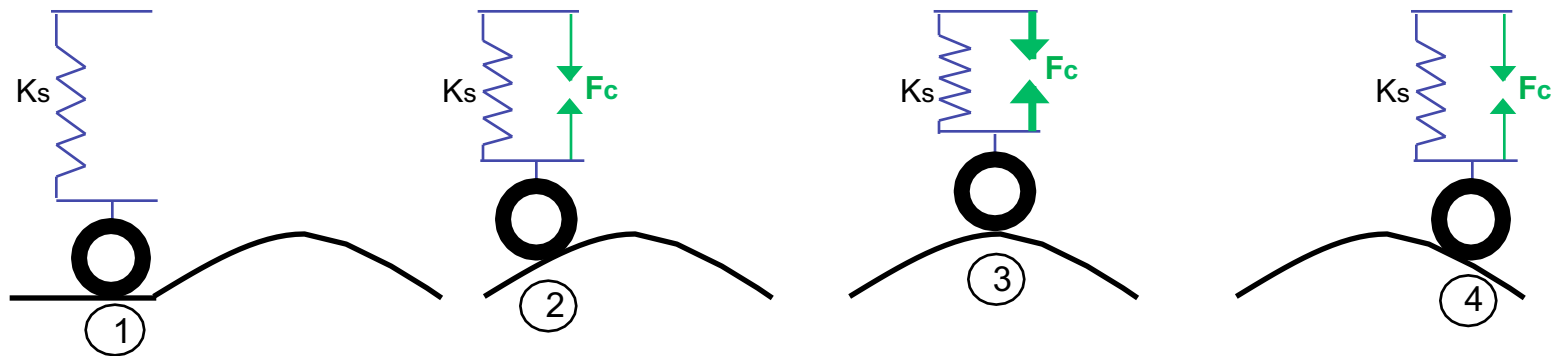
Deconstruction of a bump

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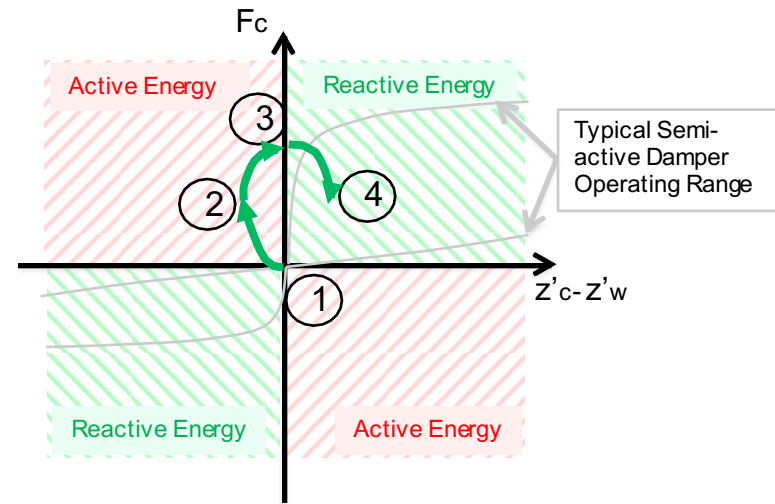
Embedded Software Architecture

# Full active control

## Speed bump example



Force vs Position



Force vs Velocity

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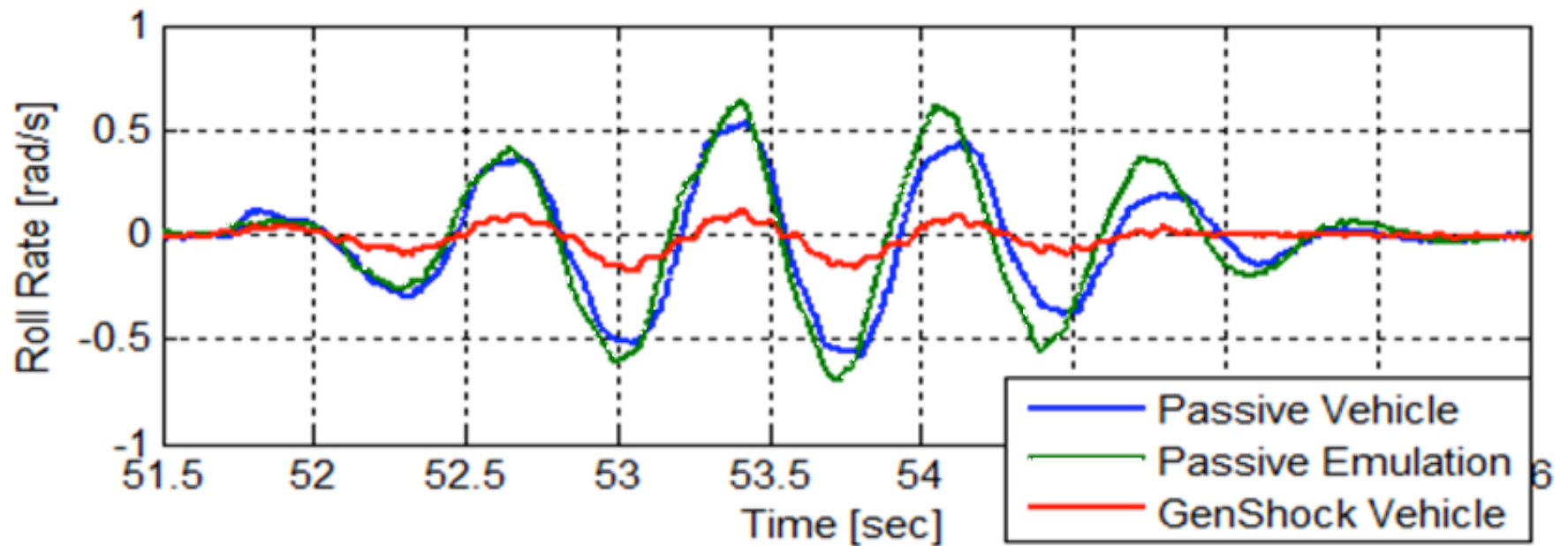
Deconstruction of a bump



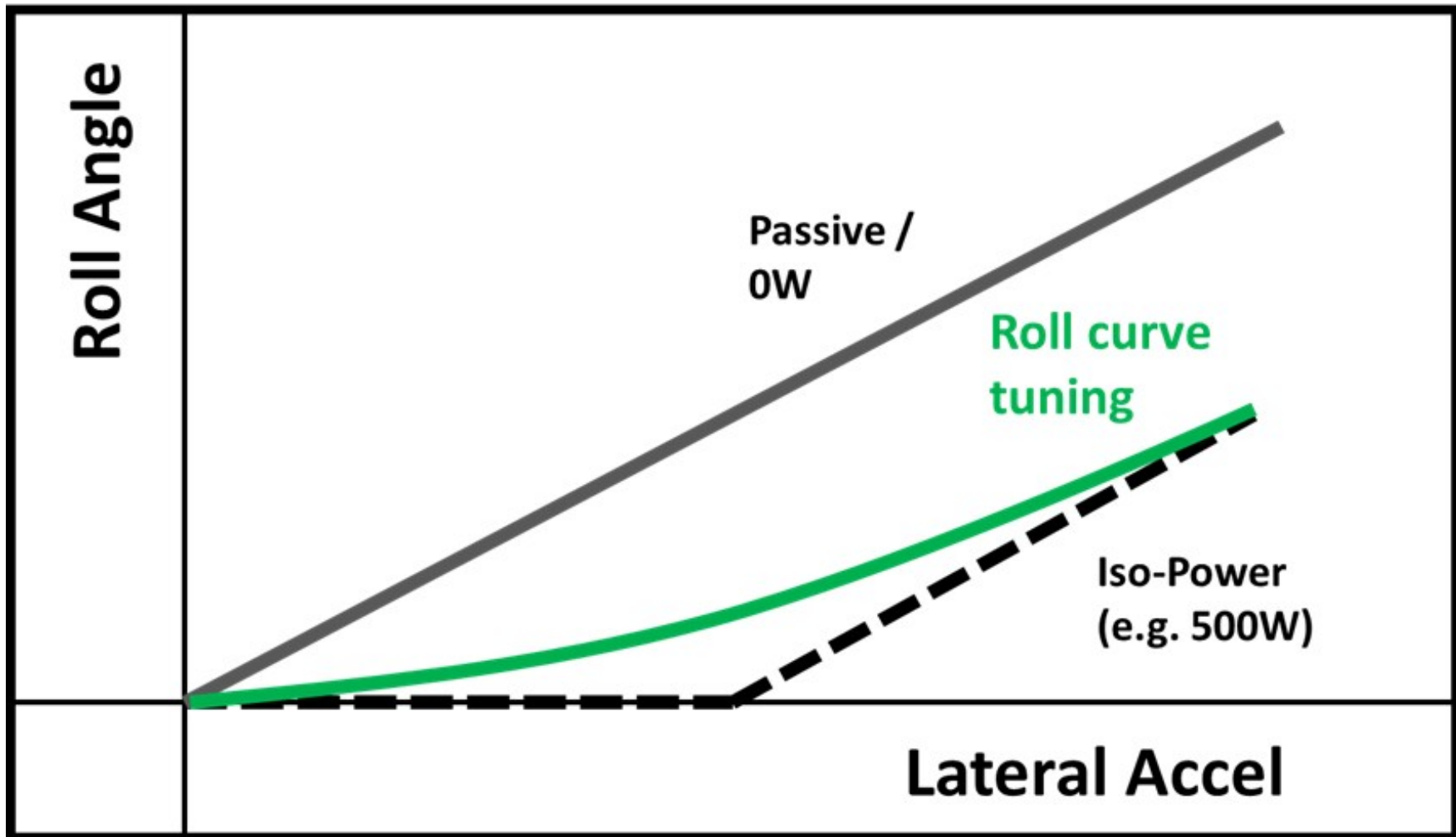
Performance & Tuning

Embedded Software Architecture

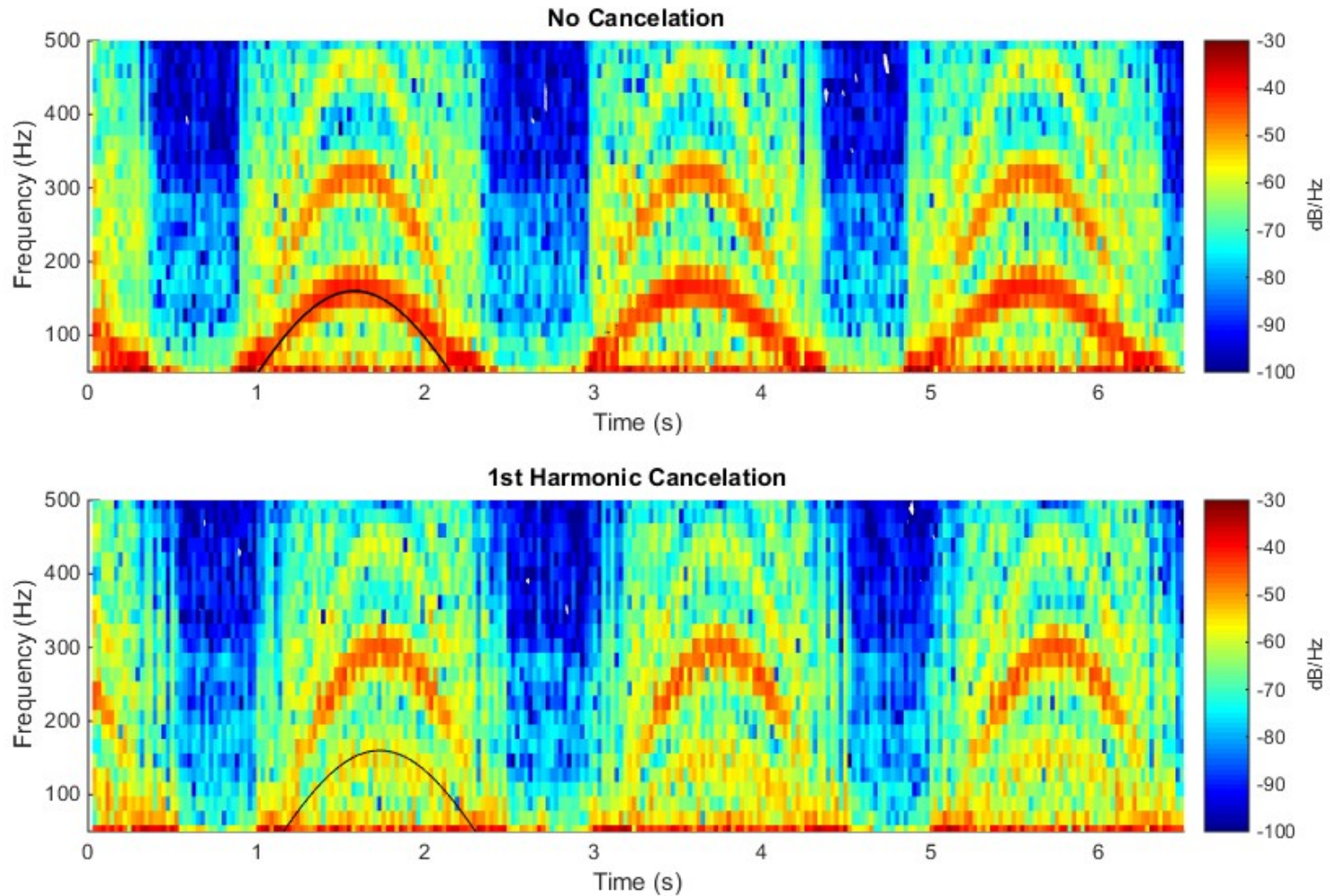
# GenShock vs. Passive Roll Rate: Offset Bumps



# Roll Curve Tunability & Power Tradeoffs



# Noise Cancellation Algorithms



Rod acceleration is reduced dramatically at the 1<sup>st</sup> harmonic

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Control Loop Timing

Performance & Tuning



**Embedded Software Architecture**



# GenShock Corner Application Software Architecture

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- Bare metal application for increased performance
- Model based design with Matlab/Simulink enables accelerated development
- Control abstraction layers create robust, verifiable design
- Standards based protocol implementations for ease of integration with OEM's

# GenShock Central Application Software Architecture

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- Coordinated control of vehicle dynamics (cornering, braking, accelerating, etc.)
- System state management (power on/off, fault management, etc.)
- Intelligent power control
- System software update

Thank You.

