SUSPENSION
SYSTEMS TECHNOLOGIES

A Short-travel, Low Friction, Passive Non-Linear Suspension for Absorbing Wave Chatter and Wave Shocks

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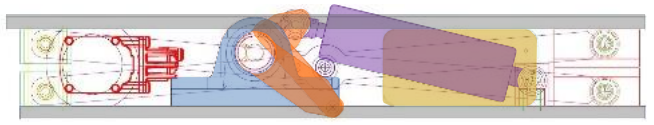
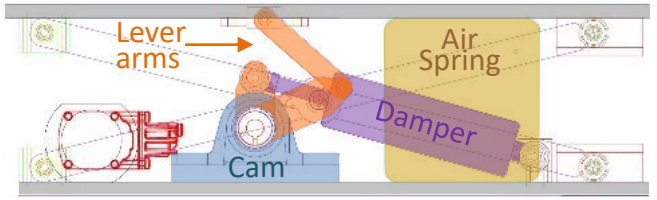
CounterRide™ is SST's Patented, Revolutionary, Compact, Low-Friction, High-Performing, Passive Suspension

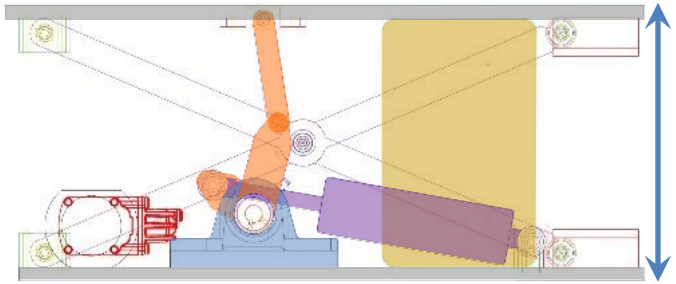
- **Superior shock and vibration mitigation with half the height**
  - Shocks and jolts are not transmitted through the suspension and absorbed laterally
  - Lever arms cancel most movements—moves the payload in the opposite direction of the terrain
- **Circular cam allows variable damper performance**
  - Superior random vibration mitigation due to minimal viscous resistance (low damping) and ultra-low friction
  - Shocks and jolts mitigated with compound, non-linear damping
- **Simple design/lower cost**
  - No electronics or controls, completely passive design
  - Design can be optimized for smooth, moderate or rough vibration environments



Bump



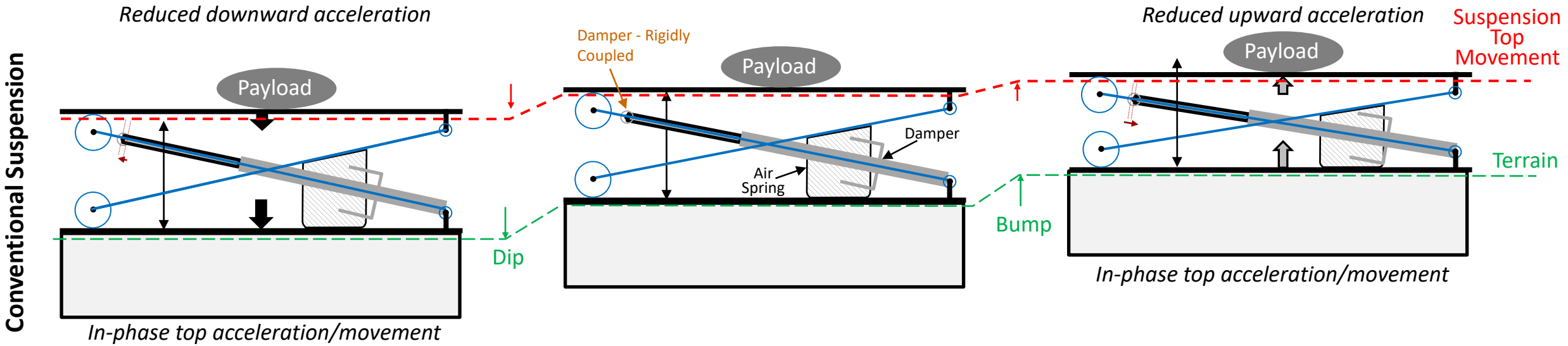
Steady State

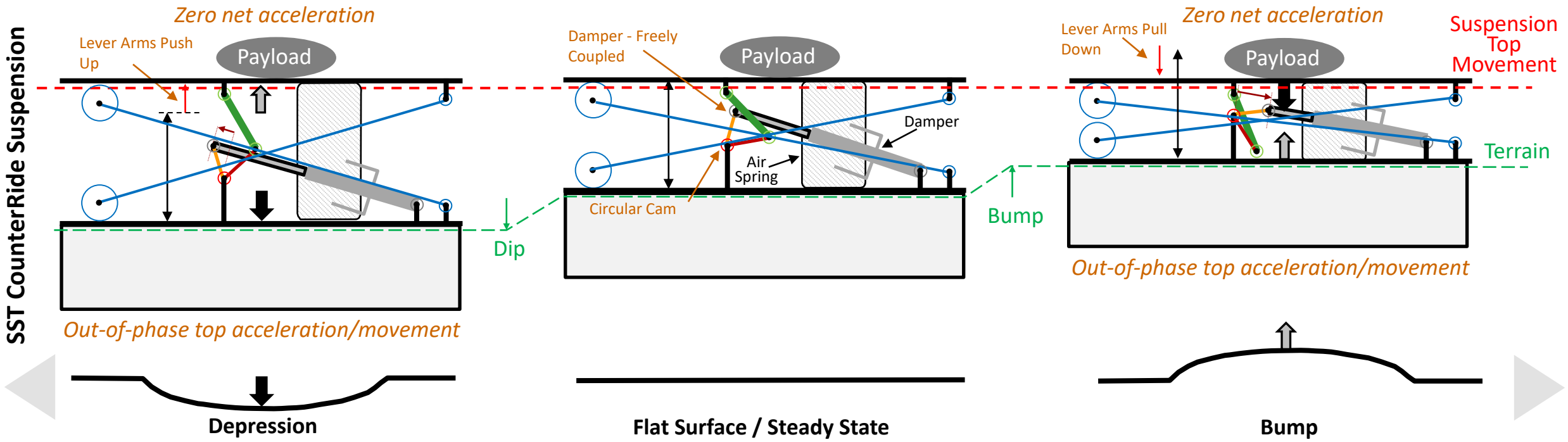


Dip

	Damping	
	SST	Conventional
2.5" 6.3 cm	5x	1x
4.5" 11.5 cm	0.25x	1x
6.5" 16.5 cm	2x	1x

How is the SST CounterRide™ Suspension Different?

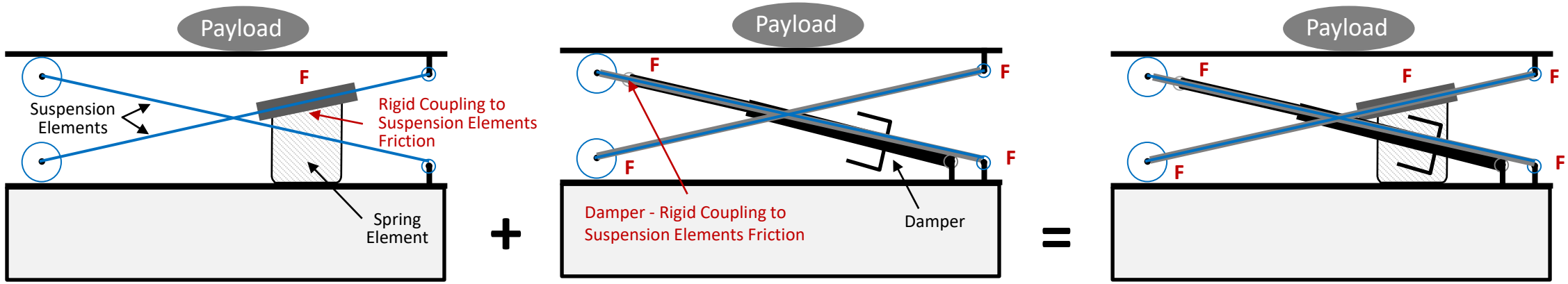




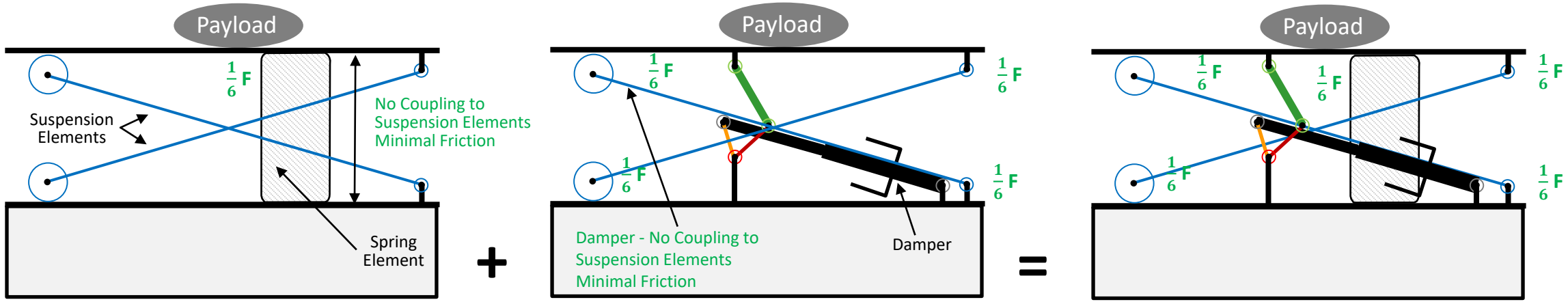
How is the SST CounterRide™ Suspension Different?

F = Sources of Friction

Conventional Suspension



SST CounterRide Suspension



Sources of Friction – Spring Element(s)

Sources of Friction – Damper Element(s)

All Sources of Friction Spring and Damper Element(s)

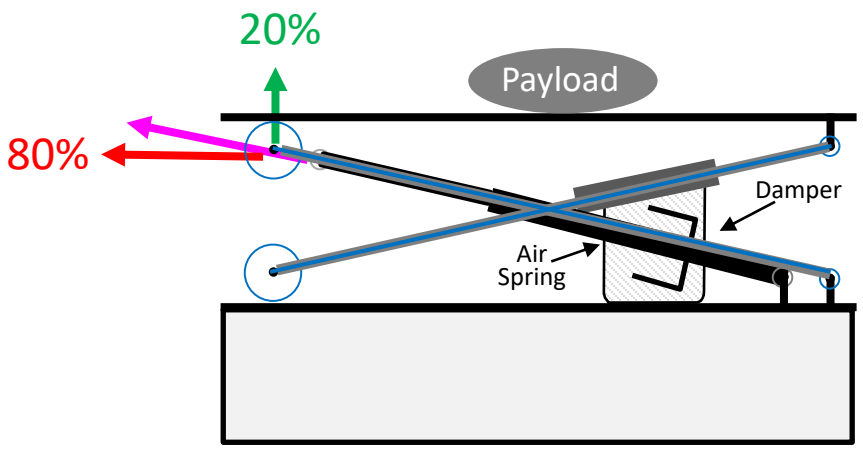
Substantially Less Static Friction

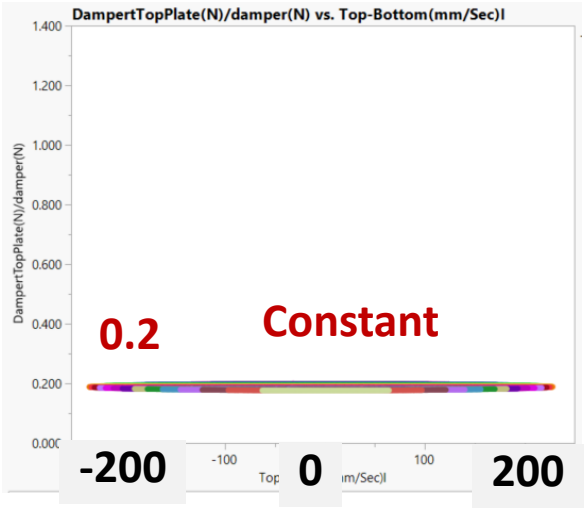
How is the SST CounterRide™ Suspension Different?

Mechanical Efficiency

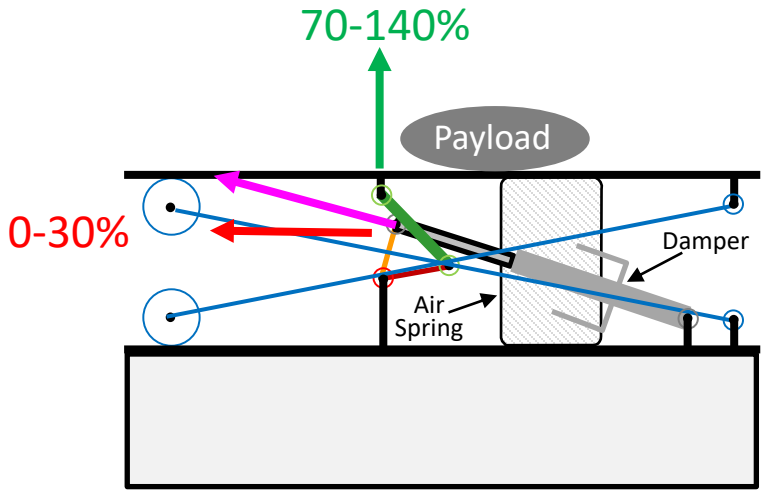
Mechanical Advantage

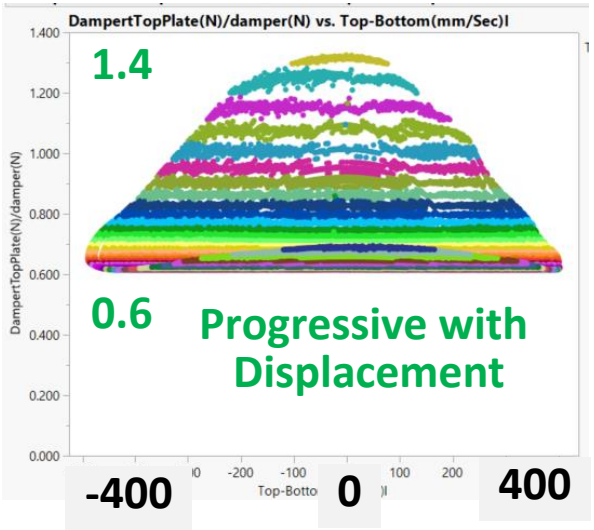
Conventional Suspension





SST CounterRide Suspension



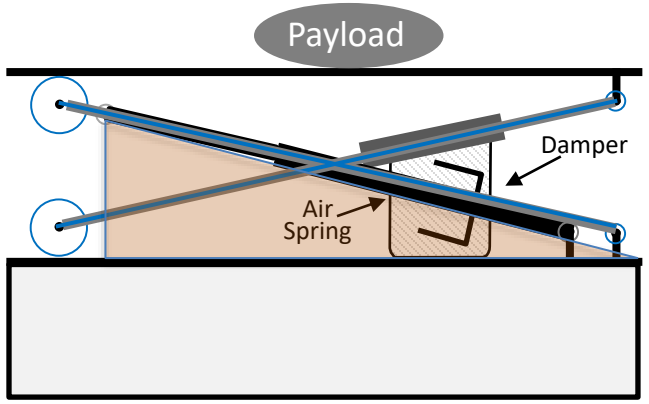


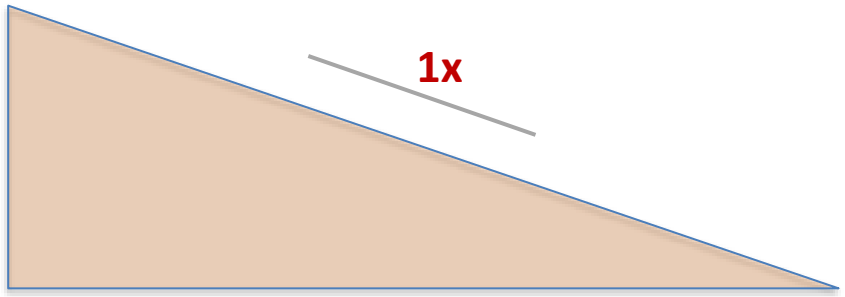
2x Damper Velocity

Up to 7-fold Greater Mechanical Advantage and 2x the Velocity

How is the SST CounterRide™ Suspension Different?

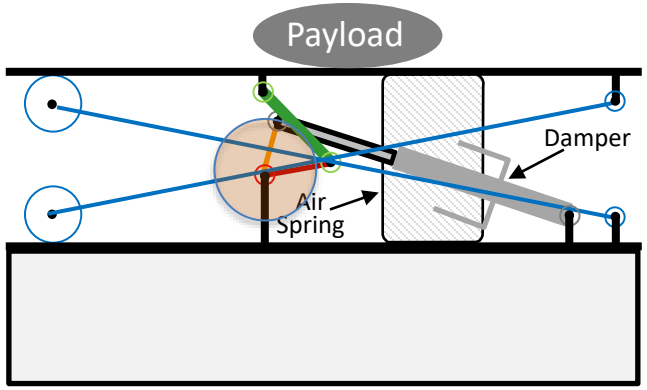
Conventional Suspension

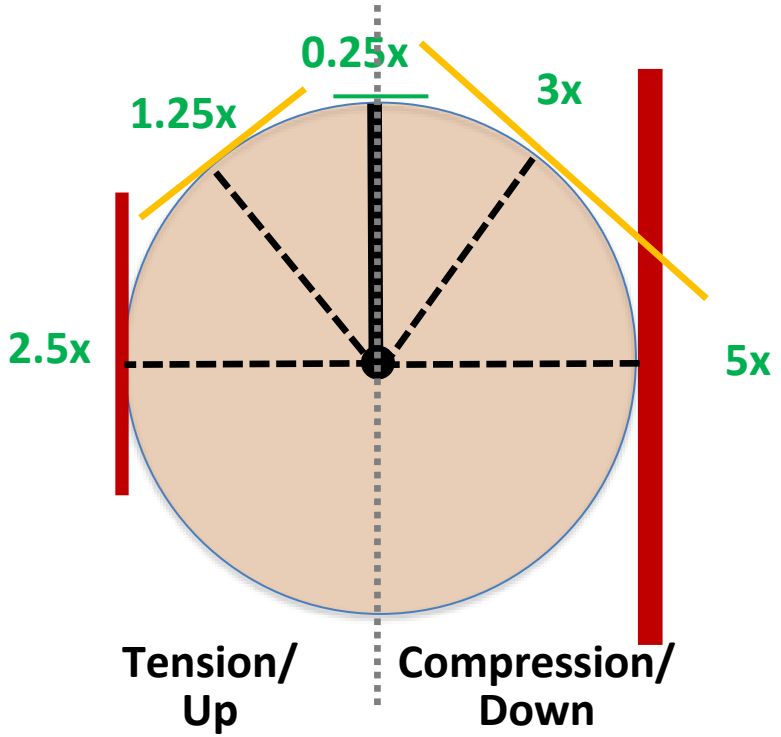




Fixed Damping

SST CounterRide Suspension

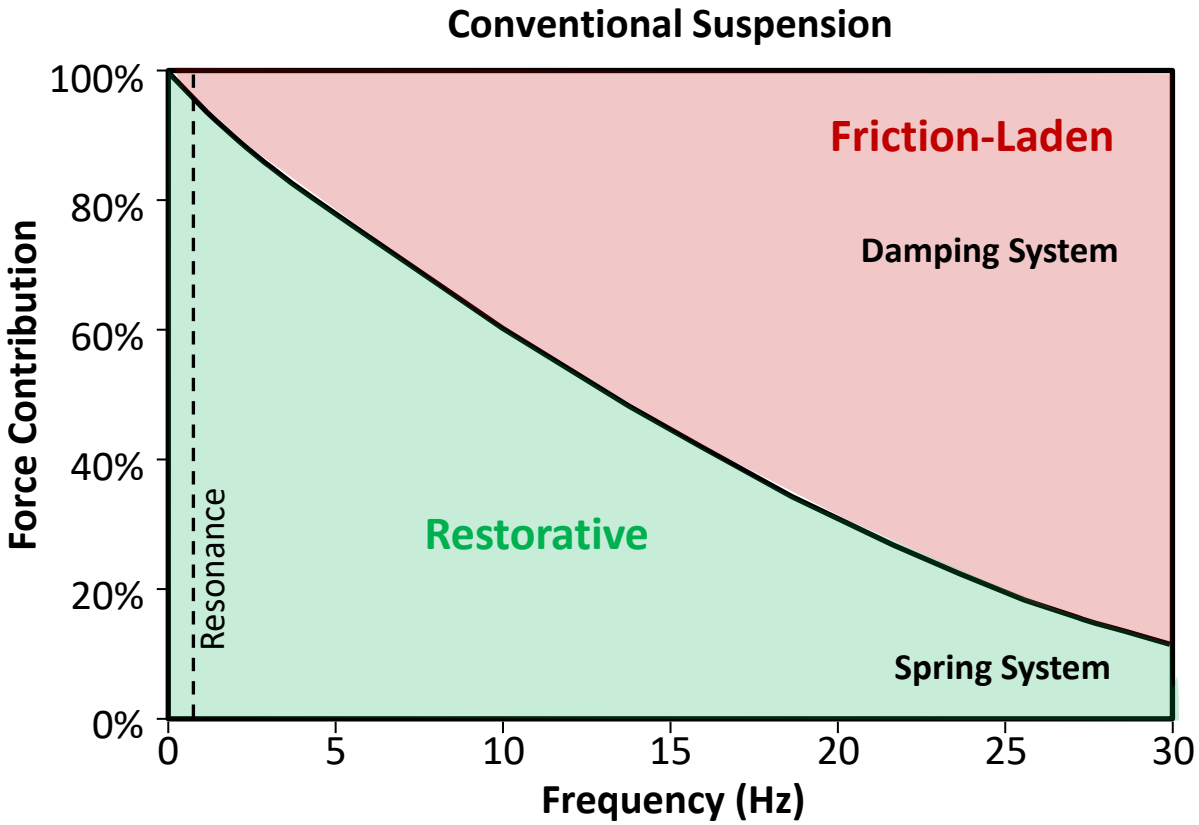


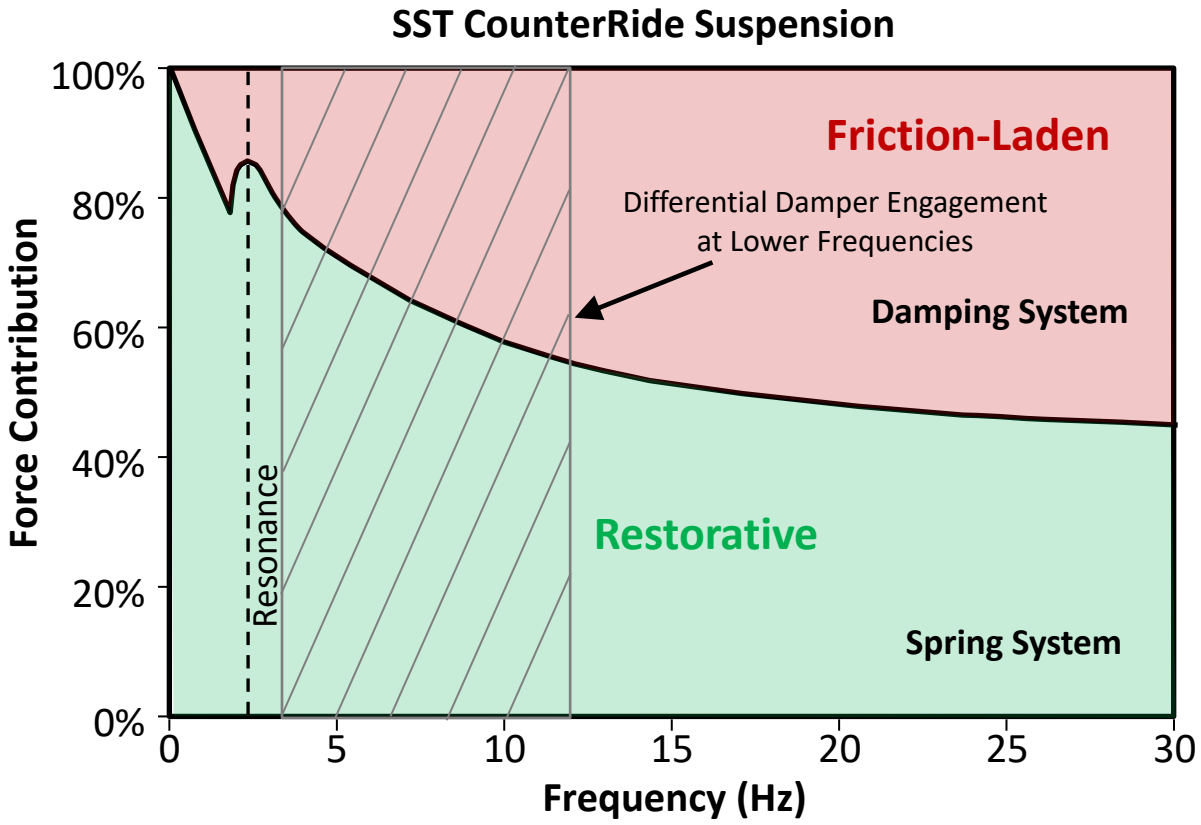


Variable Damping

How is the SST CounterRide™ suspension different?

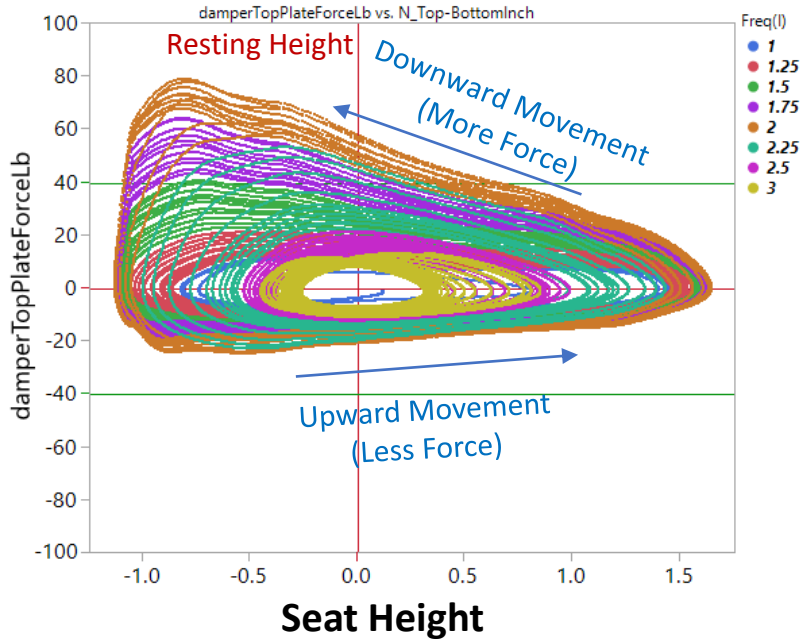
Mitigation Contributions by Spring and Damping Systems



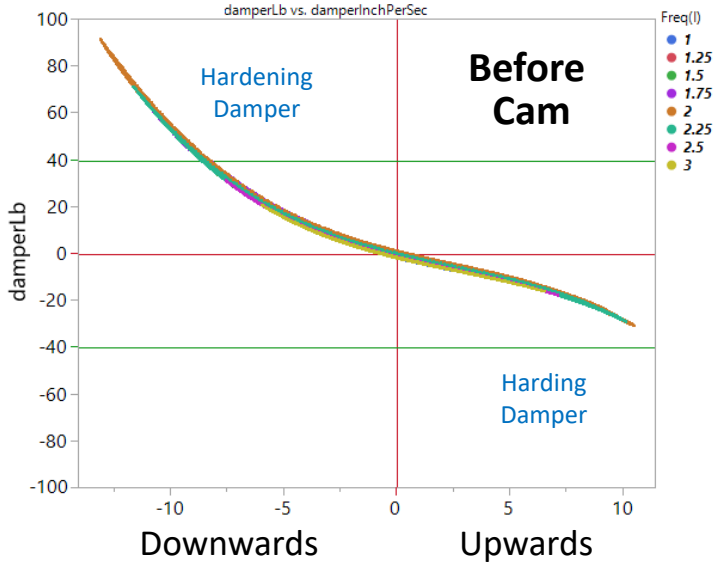


More Protection from the Restorative Air Spring – Less from the Friction-Laden Damper

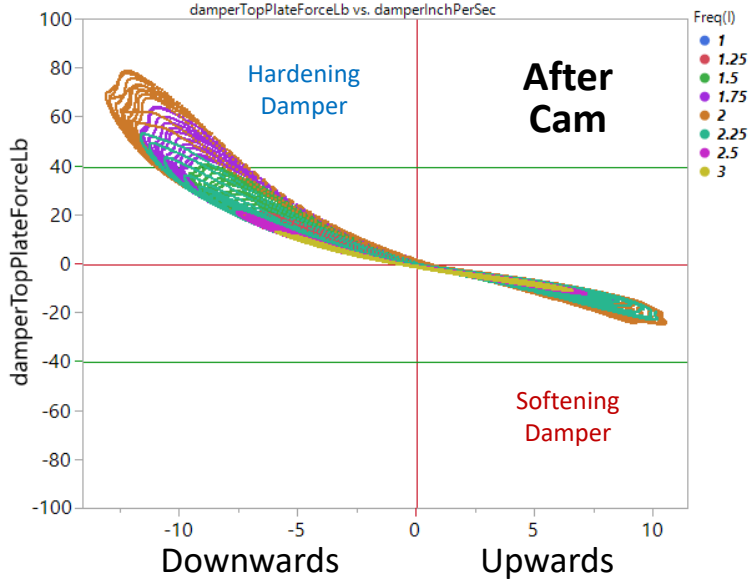
Model Results - Sine Sweep 2.5 m/s²



Seat Height

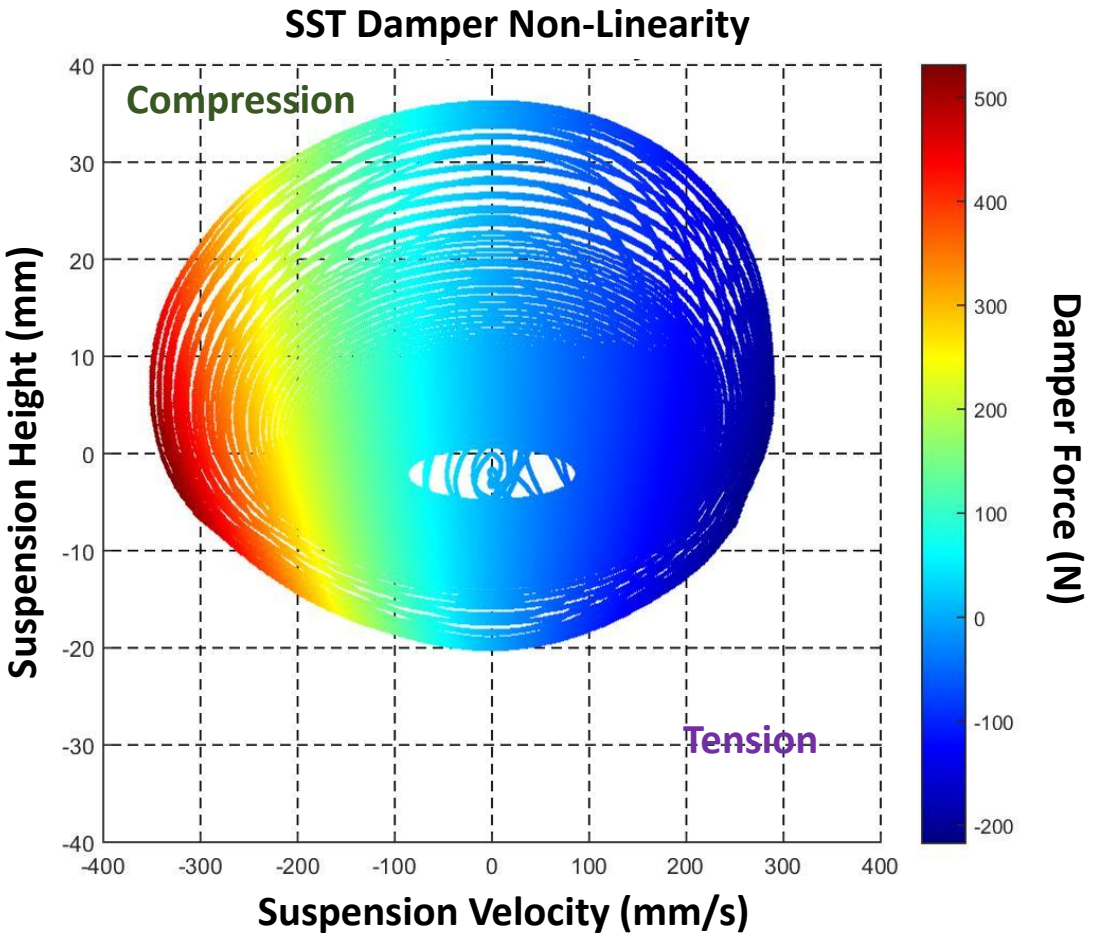


Velocity (cm/s)

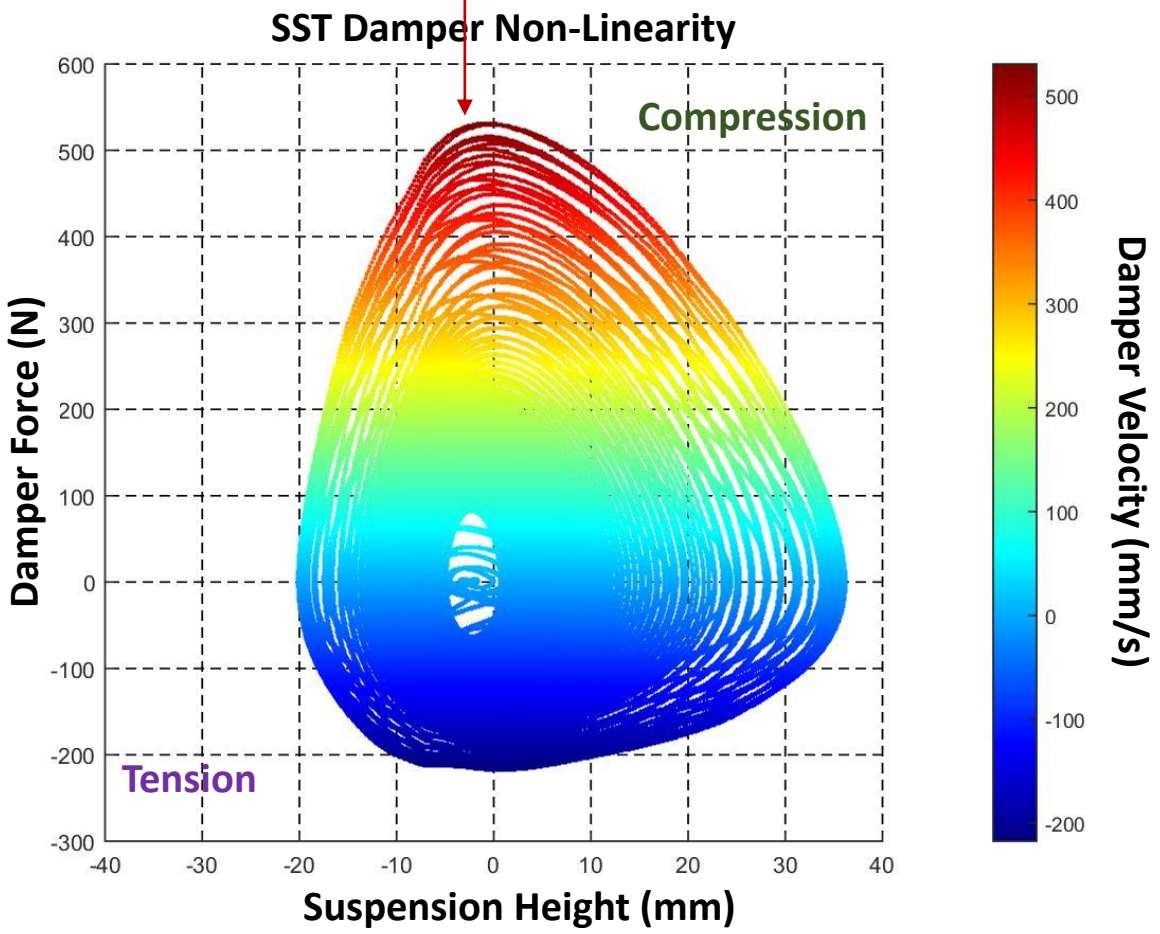


Velocity (cm/s)

How is the SST CounterRide™ Suspension Different?

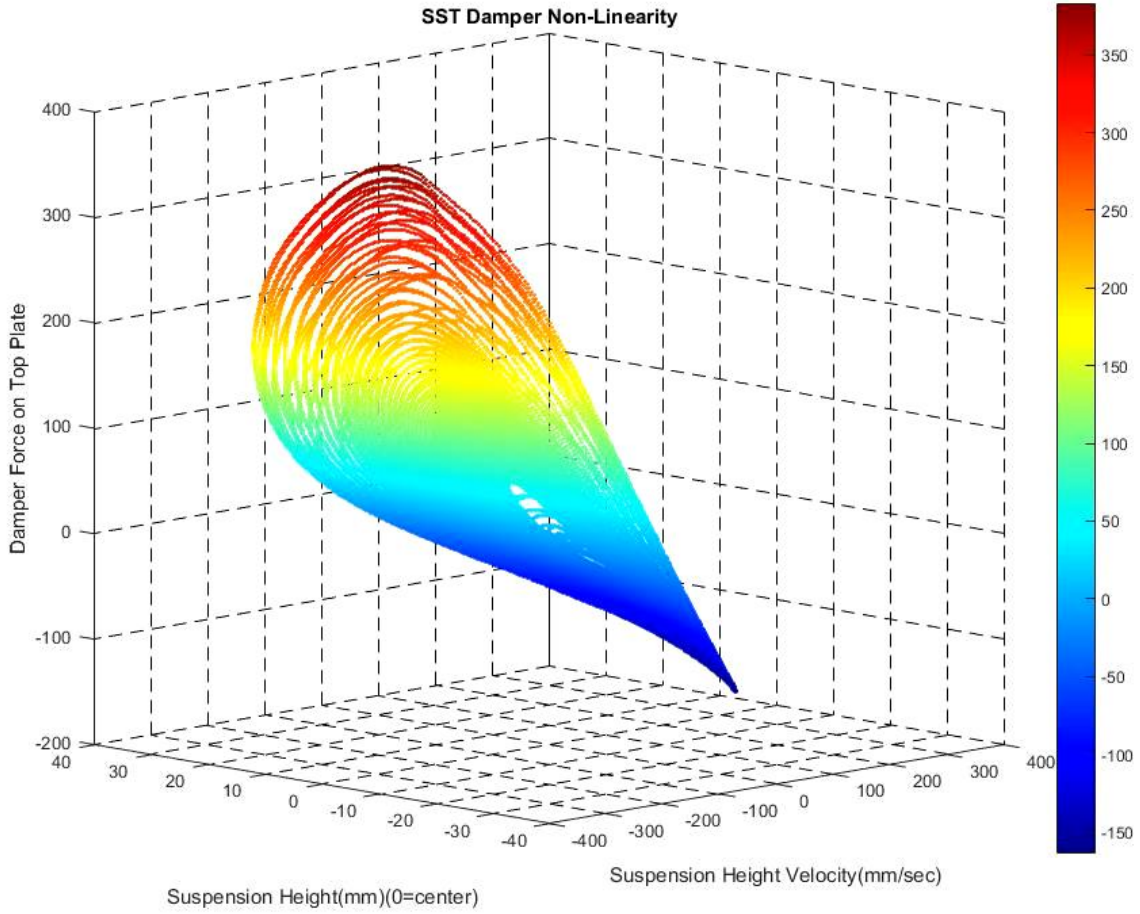


Greatest Damping at Resting Height



Greatest Damping Occurs at Resting Height to Reduce Bottoming-Out

How is the SST CounterRide suspension different?

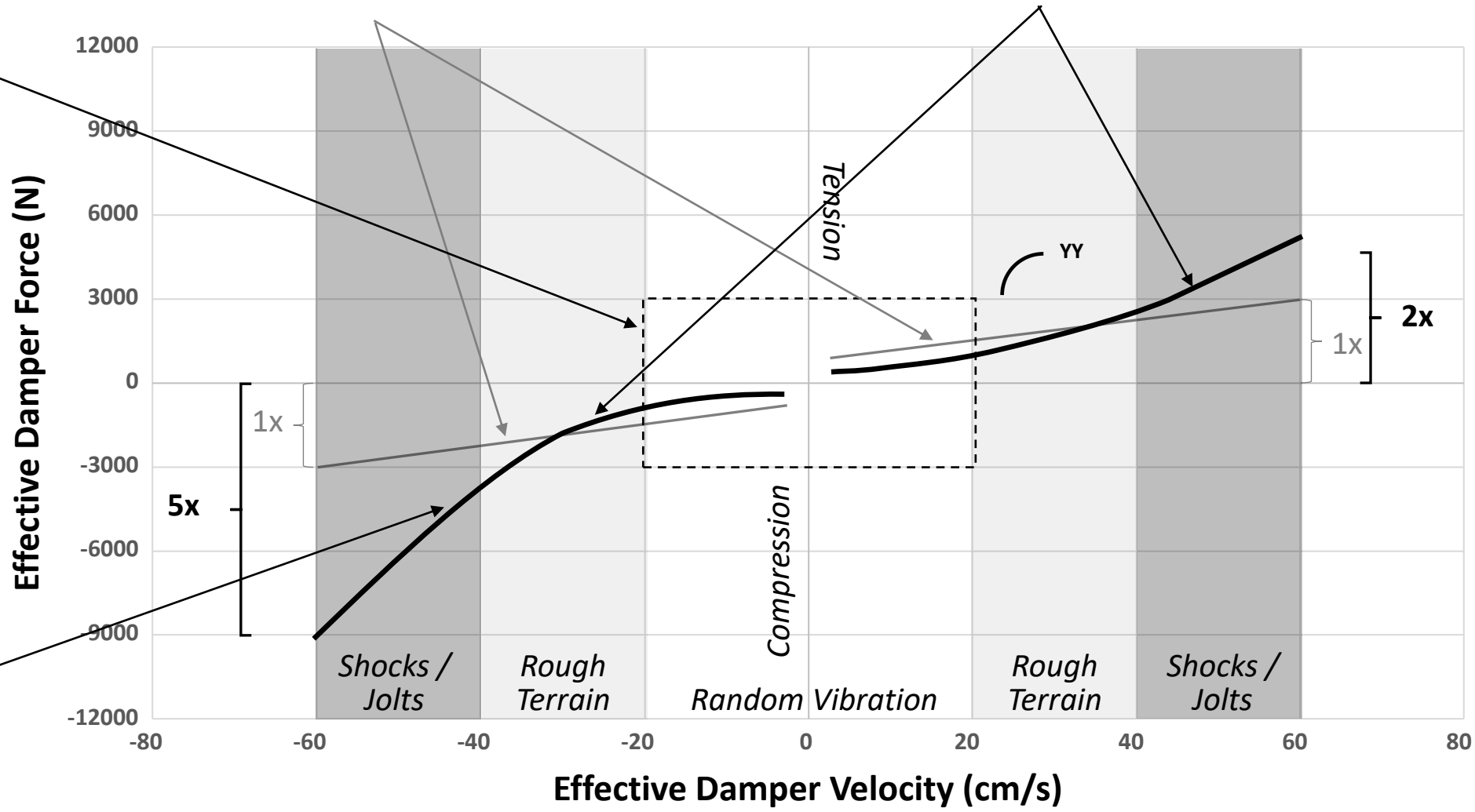


Conventional suspension – fixed damping gain (slope) with no changes in damper gain with seat compression or tension.

SST suspension – variable damping gain (slope) with damper gain differences between seat compression (4x) or tension (4x).

Compared to conventional suspensions, the SST suspension has ~3-fold less damping (much less viscous friction) in higher frequency, smaller displacement random vibration conditions. This leads to superior on-road vibration performance.

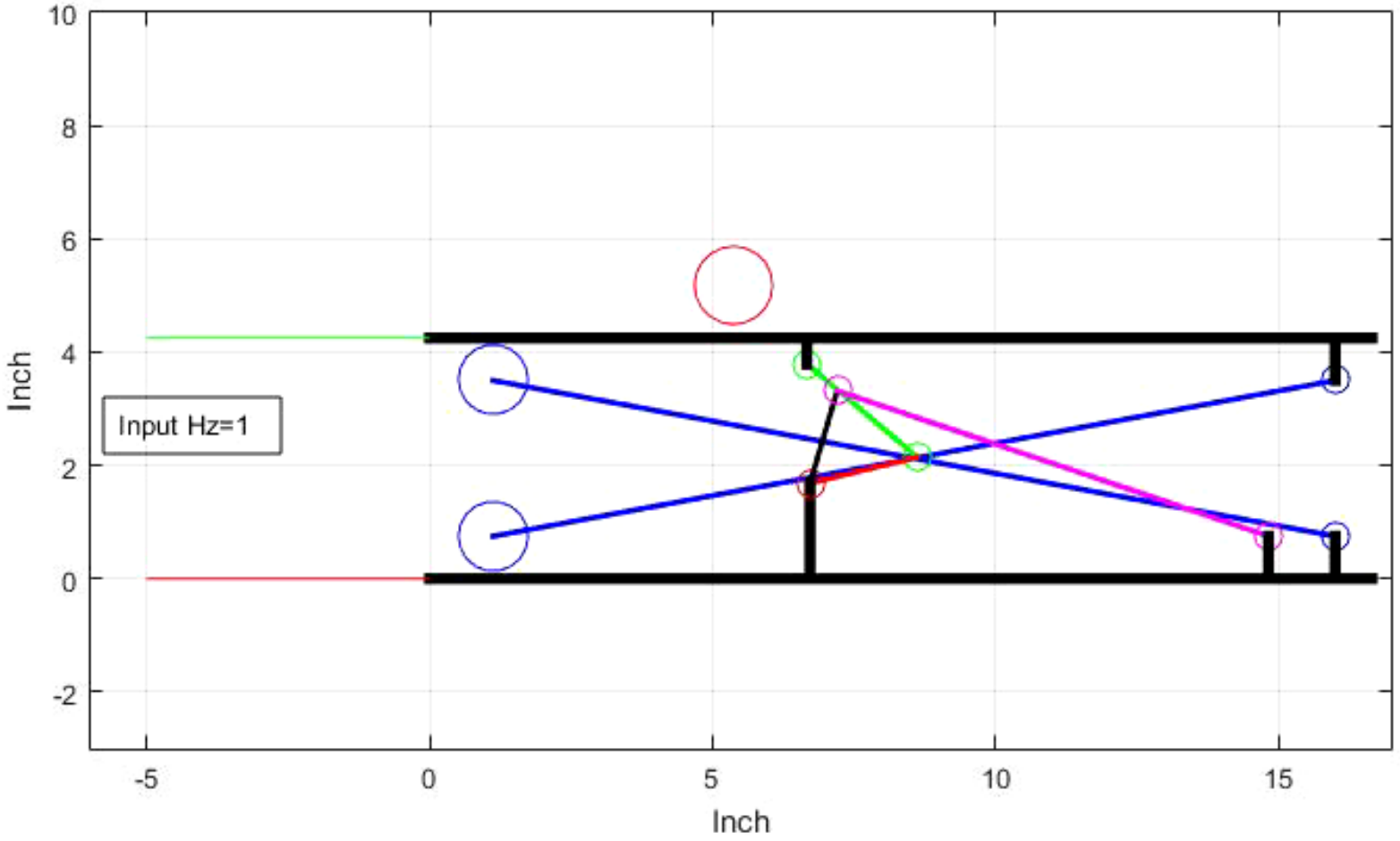
Compared to conventional suspension, the SST suspension has ~4-fold more damping in compression and ~2-fold more damping in tension. In lower frequency, larger displacement shock/jolt conditions, this leads to superior off-road vibration performance.




15 Hz

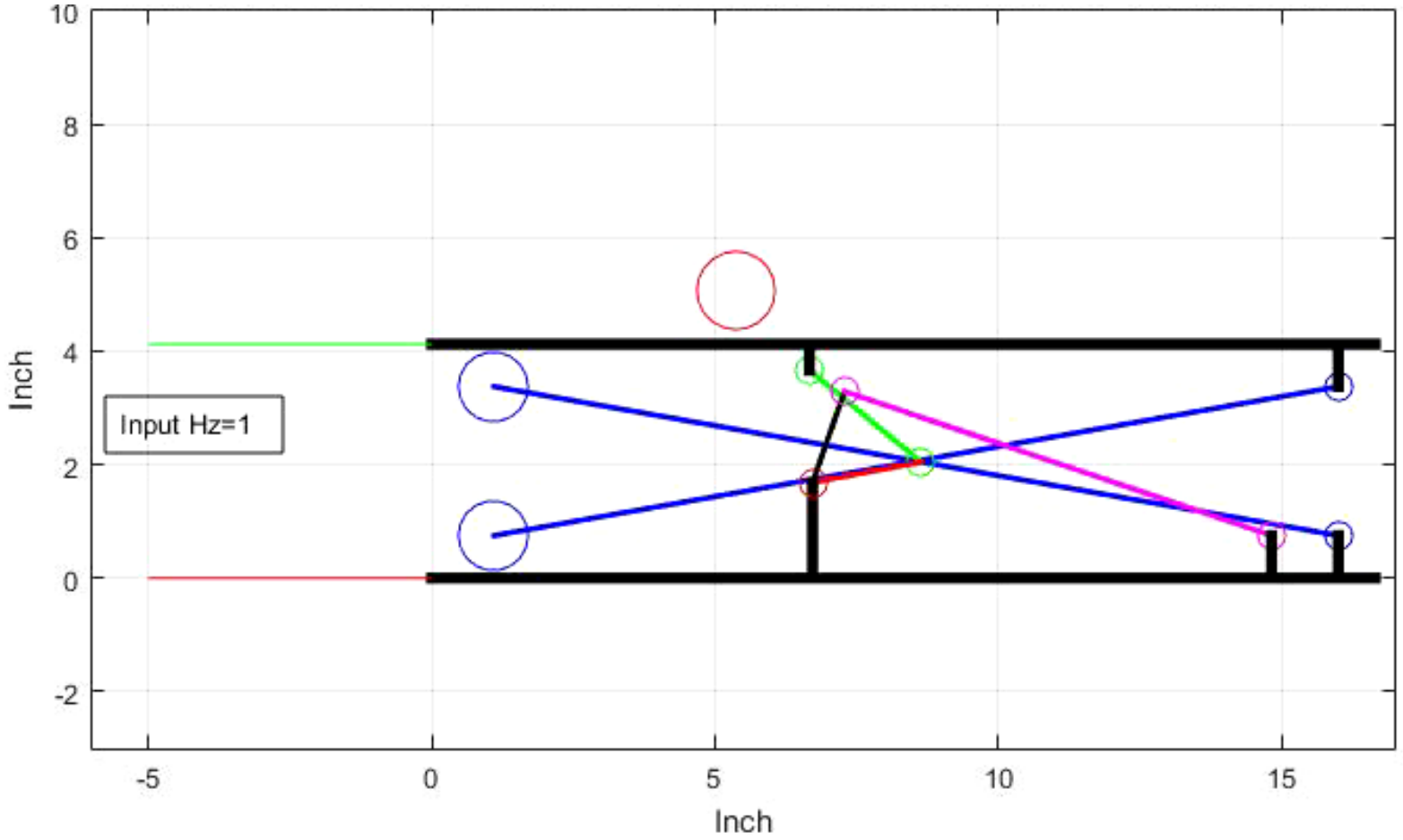
How is the SST CounterRide suspension different?

MODELING RESULTS
12 to 1 Hz Sine Sweep - 4.4 cm fixed displacement



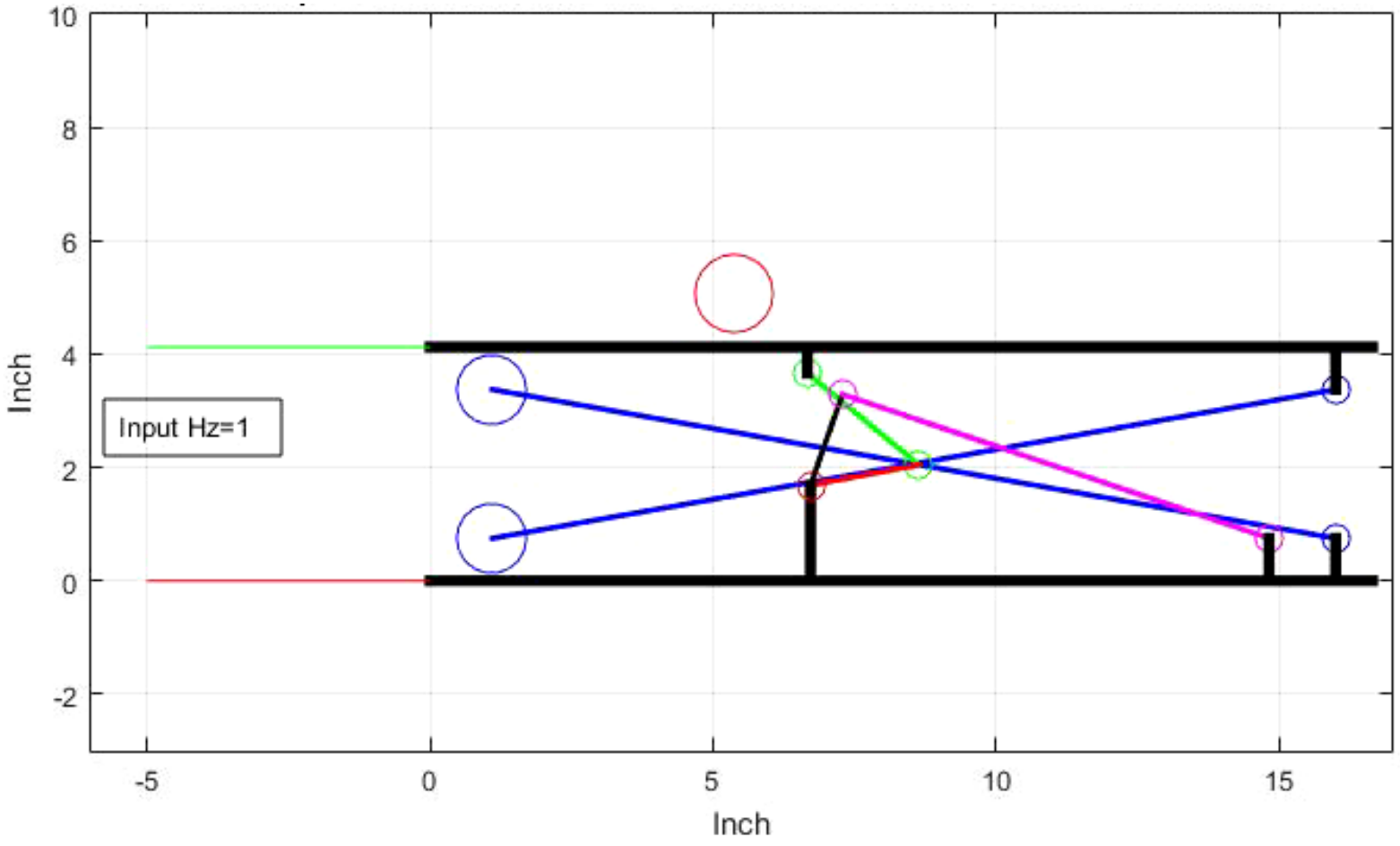
How is the SST CounterRide suspension different?

MODELING RESULTS
100ms Half-Sine Drop Test - 6g - 83kg - Light Damper



How is the SST CounterRide suspension different?

MODELING RESULTS
100ms half-sine drop test - 6g - 83kg - Heavy Damper



How CounterRide Compares

- Superior shock and vibration mitigation with half the height
- Substantially less static and viscous friction
- Circular cam allows variable damper performance
- 7-fold mechanical advantage, 2x the velocity
- More force protection from the restorative air spring, less force from the friction-laden damper
- Greatest damping occurrs at resting height to reduce bottoming-out
- Simple design/lower cost

Discussion and next steps?