# Rotary Rear Suspension

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## Introduction

Existing Mountain Bike designs use linear spring and damper suspensions.

Downfalls:
- Complex linkages
- Travel limiting pistons
- Heavy weight

The challenge is to design and fabricate a working rear suspension using a single pivot point and rotary spring/damper system.

## Design

- Sealed fluid channel
- Sealed bearings
- Custom torsion springs
- Fabricated swing-arm

- The pivot point is placed on the frame to provide best ride characteristics

## Analysis

- Von Mises stress analysis – Swing-arm and damper are strong enough
- Displacement of suspension under static load
- Flow analysis used to calculate internal fluid velocities
- Volume analysis to determine weight
- Damper modeled as fluid flow through a channel
- Damper and spring model created using Matlab

## Conclusion

**Accomplishments:**
- Single pivot point suspension system using a Rotary Damper and Spring was successfully designed and constructed
- Suspension system was successfully integrated to a hard-tail bicycle
- Increased suspension travel is feasible using Rotary Damper and Spring suspension

**Challenges:**
- Additional spring coils increase travel, but increase weight. Travel was limited in order to minimize weight.
- Manufacturability of damper restricted. Feasible damper designs are possible
- Damper seals proved to be biggest design challenge

## Construction

- Carbon Steel for ease of fabrication
- All internal damper parts are easily replaceable
- Parts made using WaterJet for high precision
- Torsion spring constructed from oil tempered steel for high strength and durability

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[Images of analysis, design, and construction processes]

[Graph showing impulse response]