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Linear Actuators for Motorsports Shaker Rig

tECHNICAL cOMMUNICATION

**DRAFT**

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Abstract

# Executive Summary

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# Problem Analysis

## Overview of problem and its significance

In motorsports, having an effective setup package is critical to being competitive. Suspension setup, in particular, is hypersensitive to specific drivers and tracks. With limited track testing time, racing teams must start optimizing setup packages earlier than competitors outside of the racetrack. One method of analyzing suspension parameters is using a shaker rig, which is a testing apparatus comprised of mechanical actuators that oscillate the vehicle’s wheels and chassis to simulate driving conditions.

According to some articles focused on miscellaneous use shaker rigs, having the rigs vibrate as precise and accurately as desired can pose a challenge. There are various types of components available to use as source of oscillations, but each has a potential problem.

## STEM fundamentals of problem

Shaker rigs work by suspending by its tires and chassis and moving them in specified directions to simulate the forces and motions encountered on a racetrack. Shaker rigs interact with the actual vehicle that is being tested which means the functionality of each component must be understood. To characterize the forces and motions outputted by the rig, sensors are fitted to a car and driven around a track (Boggs, 2009). The data collected while driving is then processed into a “drive file”, which is how the computer tells the shaker rig how to move (Boggs, 2009). The shaker rig controls the motion of each part of the vehicle with a linear actuator.

The linear actuator works by…

How do I explain fundamentals about different types of actuators that might not be used right now?

Should I explain vehicle components?

## Lessons from prior responses to the problem

The earliest shaker rigs used 4 vertical posts. [What type of actuators]. According to Dodds and Plummer in their paper titled, ” Laboratory Road Simulation for Full Vehicle Testing” (Dodds and Plummer, 2001), a limiting factor in the early days of shaker rig technology was a lack of understanding of the loading conditions and the inaccessibility of adequate testing hardware. They continue to explain that the introduction of servo-valves combined hydraulics systems’ high power with the control of electronics which opened up functionality in frequency ranges needed to operate accurate vehicle testing.

What made electro-hydraulics adequate?

As shaker rigs developed, progress was made in both the configuration of actuators and the methods used to derive a simulation model.

## Project objectives and constraints

# Candidate Solutions

## Scope of solutions considered

To improve the results of shaker rig testing, different actuators are compared…

## Explanation of candidate solutions

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A race car on a track

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Figure 1. Ayrton Senna racing for McLaren

## Comparative assessment of candidate solutions

Table 1. 3x3 Table Example

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# Project Recommendations

## Proposed solution

## Design and implementation challenges

## Anticipated project outcomes and impacts

# Glossary

# References

## Additional sources consulted