# Problem Analysis

## Overview of Problem

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

Shaker rigs work by suspending by its tires and chassis and moving them in specified directions to simulations 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 used to create a “drive file”, which is the actual computer thing used to run the simulator rig.

Not as relevant:

Shaker rig papers that have a motorsports typically discuss the modeling of the testing parameters rather than the shaker rig itself. This makes sense being that there are limited shaker rig facilities around the world and developing one’s own apparatus would be extremely costly. Perhaps something is the simulation constraints aligns with a mechanical component of shaker rigs that could be improved.

From reading multiple sources, it is apparent that most shaker rigs are designed with 4, 7 or 8 posts (connections to the vehicle). The straight forward difference is that with less posts, a more simple and inexpensive vehicle test can be carried out. Using a higher number of posts allows more parameters to be simulated and tested. However, a more sophisticated test is more complex and expensive.