CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
35120

Project Title
Active Skid Detection and Compensation for Autonomous Vehicles

Abstract

Objectives/Goals
The purpose of this project is to research and create a simple anti-skid mechanism that is suitable for autonomous vehicles.

Methods/Materials
Materials:
* A Lego Mindstorms NXT 2.0 kit, a HiTechnic NXT Acceleration sensor, and NXC programming software.
* A digital camera that can be used to measure the speed of the vehicle.
* An iPad for displaying elapsed time.
* Sand and water to manipulate surface friction.
* A homemade force meter to measure the static friction coefficient on various surfaces.

Procedures:
1. Derive the equations to predict the skid conditions of an object.
2. Build a test vehicle from the Lego kit.
3. Use the homemade force meter to measure the static friction coefficient on dry, sandy, and wet concrete.
4. Measure and observe the vehicle skid behavior without Active Skid Detection and Compensation.
5. Write the program to implement the Active Skid Detection and Compensation. Three braking sequences were tested: reduced speed, pulsing speed, and differential speed.
6. Measure and observe the vehicle skid behavior with each of the three braking sequences for the Active Skid Detection and Compensation.

Results
All three braking sequences were successful in compensating for skid. However, the differential speed braking sequence was consistently the most efficient braking sequence.

Conclusions/Discussion
The equation governing skid is surprisingly simple. An object will start to skid if the acceleration on the side of the object is greater than the critical acceleration determined by the static friction acting on it. Skid can be compensated for by using a braking sequence. The differential speed braking sequence is the most efficient.

Summary Statement
In my project, I am creating an automotive stability technology for autonomous vehicles.

Help Received
Father helped explain equations