MC105

Active Suspension Trainer

Overview

Active suspension trainer is a bench-top design to demonstrate active control difficulties for a quarter-car model. Trainees can learn in a unique, practical way that is relevant to the current automobile industry at this facility. Modern technology is being taught through the active suspension experiment, which has given rise to a new generation of vehicles. Utilizing an actively-controlled actuator mounted on the suspension axis, active suspension technology is utilized in the automotive industry to continually manage the vertical movement of the vehicle wheel. Similar technologies have also been applied to railway bogies to enhance the train's ability to curve and the passenger's perception of reduced acceleration.

Specification

- Active suspension trainer demonstrate active control difficulties for a quarter-car model.
- The active suspension trainer is made up of three masses that are supported by a system of springs and moved along stainless-steel shafts using linear bearings.
- The vehicle body is supported above the suspension and is represented by the following masses:
  - » The upper mass (blue).
  - » The bottom mass (silver) represents the road.

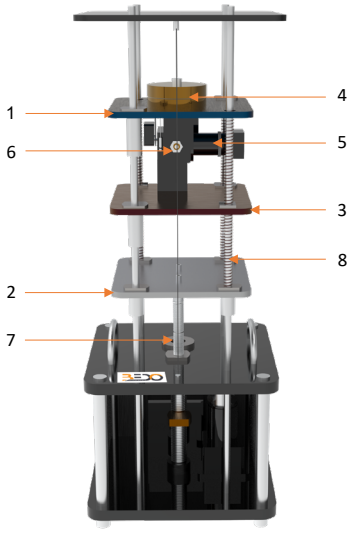
» The middle mass (red) represents one of the car's tires.

- The lower plate is operated by a strong DC motor attached to a lead screw and cable transmission system
- The upper mass is connected to a high-quality DC motor through a capstan to simulate an active suspension system that can dynamically correct for the motions generated by the road.
- The trainer consists of: adjustable weight and spring stiffness
- Three highly accurate encoders are used to measure the positions of the bottom and top masses as well as suspension deflection.
- A 226 W micromo brushless DC motor is connected to the capstan for active suspension control.
- A 70 W Mag-motor brushed DC motor is connected to the belt-drive mechanism for road actuation.
- The weight and spring stiffness can be adjusted. Accelerometer measurements are used as sensory input.
- A responsive belt-drive mechanism can simulate the movement of the road.
- For driving actuators when a responsive current control is needed, use linear current amplifier systems.
- In addition to speeding up your research, the amplifier decrease dead-band and lower noise that PWM amplifiers are known for.
- The educational unit is provided with a software to enable trainees to control the system.

Experiments

- Analyzing of the double mass, spring, and damper systems.
- Understand the industry-relevant control requirements (ride comfort, suspension travel, road handling).
- Familiarization with derivation of a dynamic model.
- Identification of a system state space representation.
- Knowing of a system transfer function model.
- Demonstrate open-loop system analysis using a sweep/chirp signal.
- Demonstrate closed-loop state-feedback system simulation.
- Understanding State-feedback control using LQR.
- Implementation of the LQR-based state-feedback control on the active suspense.

Components



1	The upper mass (blue)
2	The bottom mass (silver)
3	The middle mass (red)
4	Removable weight unit
5	Durable, precise suspension motor
6	High resolution encoder
7	Heavy-duty lead screw
8	Adjustable spring stiffness

Scope of Delivery

- Active Suspension Trainer (MC105)
- Hard copy user manual
- Bedo software

Options

- Digital content (BI01)