A Review of procedure of FSAE Suspension Design.

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Abstract

Formula Student challenges the team members to go the extra step in their education by incorporating into it intensive experience in building and manufacturing as well as considering the economic aspects of the automotive industry. The project usually forms part of a degree-level project and is viewed by the motorsport industry as the standard for engineering graduates to meet, transitioning them from university to the workplace. It is a kite-mark for real-world engineering experience. This paper deals with the design procedure of suspension and how it helps in designing the chassis for a formula student vehicle.

Keywords: Suspension, chassis, design.

Introduction

The chassis is made of a steel tubular space frame of Grade AISI 1020;there are many other options for selecting the chassis material. It is designed according to the rules of a formula student rulebook considering the factors given for the safety of the driver, handling and performance of the vehicle at dynamic conditions.

The team selects and measures all the suspension attachments after suspension kinematic analysis and powertrain attachments and enter all the data into a CAD program, when everything is entered, then the chassis almost designs itself. Which is better than building the chassis physically and designing suspension geometry and powertrain to fit the chassis.This paper is limited to Suspension Design procedure and its effects on chassis design.

Gathering information for the teams attempting for the first time is a big task. The team took it's reference from the guidance provided by formula student organizers, FSAE forums, FSAE TTC, Books on vehicle dynamics, tutorials on YouTube and Social Media platforms.

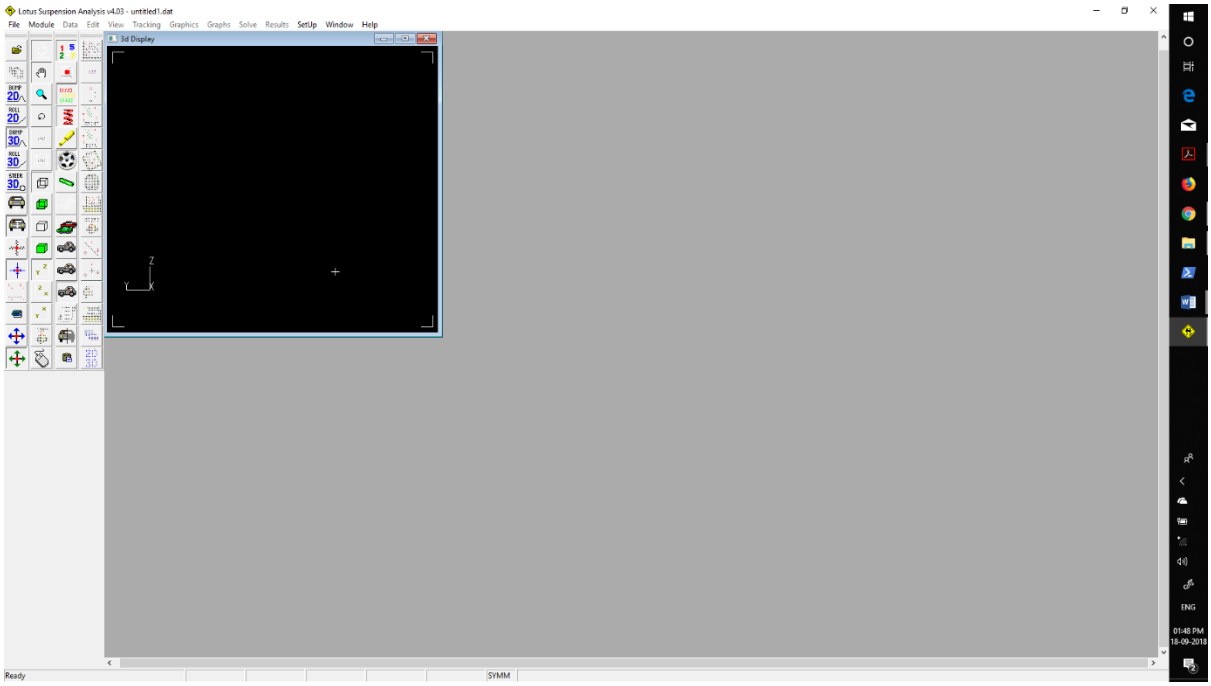
Method

Suspension geometry means the broad subject of how the unsprungmass of a vehicle is connected to the sprung mass. These connections not only dictate the path of relative motion, they also control the forces that are transmitted between them. Forces like weight, longitudinal forces (motive force, aerodynamic drag or rolling friction), lateral forces (e.g. steering force, centrifugal force when cornering or crosswinds). Opposing forces act upwards from the road onto the tires.
This formula vehicle uses Unequal length double A arm. It consists of two arms, the upper arm and the lower arm. The upper and the lower arm are of two different lengths. The Spring and dampers oriented horizontally are actuated through the pushrods both at the front and rear.

By the use of Push rod or Pull rod suspension you can get Restrictive wheel movement, it means you can get more stiffer suspension with the use of same dampers by changing the motion ratio and length of push rod.

The suspension is the first thing to design and decide according to our needs of the vehicle in terms of safety, handling, performance which was achieved by knowing what are the parameters involved in suspension kinematics and what values of those parameters gives you the best results.

Lotus Engineering Software (lotus shark) was used for the analysis of Suspension Design.



Any particular geometry must be designed to meet the needs of the particular vehicle for which it is to be applied. There is no single best geometry.

Data Regarding Tires, Springs and Dampers, track-width and wheel-base are required for analysis.

And while physically building the car, considerations like Upright, A-Arms, pushrod are taken from the design analysis and material research to avoid compliance.

Result:

Since it is mentioned at the beginning of this paper that fixing all the attachments to the bracket (initial chassis) in the CAD software will design the chassis itself!

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