THE UNIVERSITY OF TEXAS AT AUSTIN
COLLEGE OF ENGINEERING
Department of Mechanical Engineering
Austin, Texas 78712

Society of Automotive Engineers

ANNOUNCING THE 1983 FORMULA SAE COMPETITION

The Student Chapter of the SAE at the University of Texas at Austin will host the Formula SAE Competition in 1983. The tentative date for the competition is the 27-28 of May 1983. Formula SAE cars are expected from as far away as Canada and Mexico.

Rules and general information are contained in SAE publications #821092 and #821093. Copies of these publications may be obtained directly from the SAE. Copies may also be obtained from the student chapter of the SAE at the University of Texas for a $2.50 charge per publication. The 1983 rules have been modified slightly to reflect the following changes:

1. A different scoring system - points will be assigned by finishing position in each heat.

2. 8" - 13" wheels instead of 9" - 13" wheels.

3. 1/8" extended metal safety shields instead of 1/8" plate (subject to approval of judges).

4. 1 gallon fuel tank instead of 1/2 gallon.

5. Vehicles MUST have a Formula or Indy-type body.

A $100.00 entry fee will be required for all entries. The field will be limited to a maximum of 15 cars. The deadline for submitting your entry will be April 29, 1983.

The student chapter of the SAE at the University of Texas extends this invitation to any interested chapter to attend. If you need further information, contact:

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Longhorn Racing Team

821092

Design of a Formula SAE Race Car: Vehicle Dynamics and Performance

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ABSTRACT

A design guide for vehicles is presented, including considerations of vehicle dynamics and vehicle performance. The various aspects of vehicle design are both qualitatively and quantitatively discussed, including presentation of the relevant theory, governing equations, and design options of interest for a small race car such as a Formula SAE vehicle. Relevant conclusions drawn from the theoretical analysis are presented.

THE FORMULA SAE COMPETITION is a new event based on two previous Mini Indy contests (1)*. The Formula SAE competion includes endurance, acceleration, maneuverability, and fuel economy events. The general aim of the competition is to design and build a low powered formula-type racing vehicle to compete in these events. This paper describes the criteria and design techniques that may be used in the design of a Formula SAE vehicle. The final design of the vehicle entered in the 1981 competition by the University of Texas is used to illustrate the application of this design procedure.

As well as competing in the four performance events, the car must comply with the various technical and safety rules of the competition, including: 1) the vehicle must be able to carry a person 6 feet tall weighing 200 pounds: 2) a cost ceiling of $1750 must be observed; 3) the brakes must be capable of sliding 2 tires on dry pavement or of stopping the vehicle within 25 feet from an initial velocity of 20 MPH; 4) the vehicle must be of student design and construction. An additional constraint on the University of Texas team was that the car had to designed and built in one semester.

From the above constraints evolved criteria used to evaluate the different concepts and designs. The criteria used were: 1) cost, 2) performance, 3) ease of construction, and 4) availability of materials. The design of the different components (steering system, drive train, frame, and suspension) were generally based on a compromise among the four criteria.

*Numbers in parentheses designate references

FRAME

In general, a race car frame should be designed around the vehicle's components (steering, drive train, and suspension system), and the frame should be light, durable, and have high torsional and bending stiffnesses. To meet these constraints, a triangulated multitubular frame using one inch square steel tubing was designed (see Figure 1). Though the frame aft of the cockpit was designed to accommodate the drive train and rear suspension, the frame from the cockpit forward was designed before steering and suspension units were designed so that vehicle construction could begin.

To analyze the frame, a finite element, static analysis computer program was used. The major loads imposed on the frame, however, are dynamic loads. Consequently, loads determined from the dynamic suspension model (see Front Suspension section) were used as static inputs to the frame modeling program. Thus, a relatively simple computer model aided in formulating the final design of the frame.

A more sophisticated finite element program (allowing the modeling of dynamic inputs) such as those used by some professional formula car designers, would have been of greater value. The weight of the as-constructed UT Formula SAE car frame was about 150 pounds (total vehicle weight was 500 pounds), but the weight could have been reduced significantly by using a dynamic frame analysis program. Unfortunately, time and manpower limitations prevented exploration of this potential.

SUSPENSION

The primary functions of the suspension are to isolate the driver from the road vibrations

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