Dawson Aerospace Club

FSAE Report

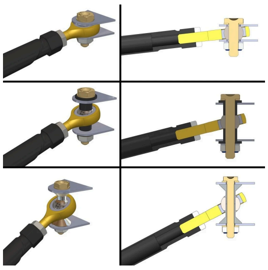
Steering System - Nicholas Tirschler

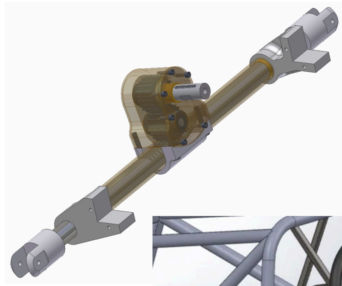
Overview

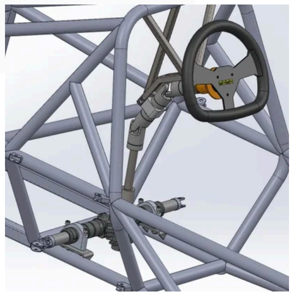
The steering system of a Formula SAE car is, as you might expect, very important. The main purposes of this system are to allow the driver to sense what is happening at the front tires, be responsive enough at high speeds yet still allow turns at low speeds, all while supporting the loads associated with turning the car at high speed.

Steering As I Understand It

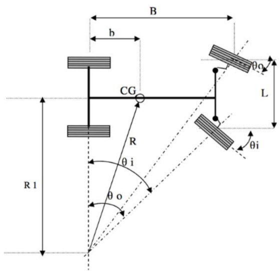
The most bare bones steering system works as follows: a **steering wheel** is connected to a **steering shaft** which is connected to the **pinion** of the **rack and pinion** which is then connected to the **wheels** using a **tie rod**.







Steering wheel: self explanatory, quite a few regs. in the rules.
Steering shaft: usually two shafts with a universal joint in the middle. (Right Down)
Rack and Pinion: takes in rotation input from the steering wheel and turns it into translational output for the wheels. (Right Up)
Wheels: self explanatory, refer to the wheels section.
Tie Rod: a connector which allows the steering to move the tires while letting the suspension move the tires up and down. (Left)



To allow the car to turn better, we could use something called "The Ackerman Principle" where one wheel turns more than the other allowing the car to turn more efficiently. (Left)

How we would build it

Now that you are familiar with the basics of the project, here is how I would create this system from scratch. To begin with, you need the specs, what load will the steering need to support, how fast will the car be going when it needs to turn, ect. Once you know your engineering restrictions, you can accurately build the part to support the requirements. This system is made of many subsystems so I would recommend making these systems separately and putting them together in the end. One is the steering wheel, we would 3D print it out of carbon fibre filament, then wrapping it in carbon fibre cloth. Finally, we must add a quick release hub to allow the steering wheel to be removed in the event of a crash. Two is the steering shaft, this might require some welding and buying of steel rods and joints. The rack and pinion is an opportunity to use **CNC machining**. It is a highly important structural part, I just don't know if the CNC machined parts will be strong enough to support the weight.

The tie rods will likely need to be bought but we could definitely look into buying them ourselves. Another use for **CNC machining** is structural parts. All the components are not floating in space, they are attached to the frame and each other. They could be attached even using aluminium CNC parts.

Cost

The largest cost is likely machining the rack and pinion system (100-200). The rest of the system is about $100 for 3D print + carbon wrapped steering wheel + quick release hub, $20 for steer shaft, $50 for U-connector and $100 for rack and pinion to wheel assembly. All-in, **600$** will guarantee this project's success.

Conclusion

Steering is a relatively simple system composed of a few very simple subsystems. I would say this could definitely be built without a garage and stored easily (In makerspace or even a locker). For $600 we definitely could get started on this and build it in the school. I think we should include this in our SAGE proposal. I could definitely split up the tasks between a few younger students with relatively low experience.

Sources

For any reference to the rules: [FSAE 2026 Rules]

Page 21

Good paper about the use of solidworks and "Lotus Shark" to design steering systems: [Paper]

Ok overview of creation process: [Article]

Cool photo I saw on one website (right)

Engine and Battery - Julian Ursino

The following is a summary of the information required to procure and install the engine and battery for an Electric Vehicle (EV) that is compliant with Formula SAE regulations. I would like to note that the word “engine” is being used somewhat colloquially here for simplicity’s sake and can refer to the motor or the drivetrain in general.

Firstly, I would like to establish the parameters that the FSAE regulations impose upon these parts.

The engine cannot exceed the maximum power of 80 kilowatts.

The voltage between any two points on the engine cannot exceed 600 Volts (Direct Current).

It is acceptable (but somewhat financially wasteful and ill-advised) to use an engine that exceeds these limits provided that the car is not designed for these limits to be crossed although as a rookie team it may not be wise to do this. This option would also be more expensive and somewhat inconvenient, so it is recommended to procure a motor in the 60-70 kilowatt range.

In multiple public forums, the EMRAX 228 motor was recommended as a cost-effective and easy to work with option for an inexperienced FSAE team. It conforms with the standards imposed by the regulations and there are multiple listings online to purchase one secondhand (a recommendation for cost cutting given the steep price of other components) for between $3 000 to $5 000 USD, which is also comparable to prices of similar engines procured secondhand. Purchased brand new, the price for the motor would most likely land in the $6 000 to $9 000 USD range.

As an example of a manageable drivetrain design that could use the EMRAX 228 or a comparable motor, I have attached the Wisconsin Racing documents page, one of the best public resources for FSAE designs. They contain information about the accumulators and inverters that could best suit our drivetrain (if we decide to follow their designs) as well as what batteries would be ideal given FSAE restrictions.

References

EMRAX 228 Info
https://r.search.yahoo.com/_ylt=AwrFfbE0UFZqaQIASHXrFAx.;_ylu=Y29sbwNiZjEEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1785251125/RO=10/RU=https%3a%2f%2femrax.com%2fe-motors%2femrax-228%2f/RK=2/RS=.mrodJifvYg0hY1VpF0A6vtBWpo-

Formula SAE Rules 2026 Version :https://r.search.yahoo.com/_ylt=AwrE_LpTjlNqXwIAAIHrFAx.;_ylu=Y29sbwNiZjEEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1785070419/RO=10/RU=https%3a%2f%2fwww.fsaeonline.com%2fcdsweb%2fgen%2fDownloadDocument.aspx%3fDocumentID%3d278fd4d7-aa27-4e33-bc4a-090148e662a0/RK=2/RS=xWjEp0PEZTjVaLcEsqsZEADb7_g-

Wisconsin Racing Sample Designs: https://www.wisconsinracing.org/documents/

Safety Rules - Will Comptois

SAE rules.docx –> (rule document)
The rule document is divided up into 12 sections:

- General Regulations (GR)

The basic rules defining what the competition is and how we're being evaluated. The competition is divided into what they call static and dynamic events. Dynamic events are challenges with driving the car that measure performance while the static events are challenges more about the car itself measuring costs and our ability to sell a prototype.

- Administrative Regulations (AR)

These rules are mostly about the membership of the team and registration. Some specifications include being over 18, being a student of the college participating, being a member of SAE International, medical insurance and for the driver a driver's license. On the website itself only team members and team captains can upload documents.
Fast Track Roster Management - Community Programs SPRT - Confluence

There are also some advisory roles such as Faculty advisors, Electrical System Officers (ESO) and Electric System Advisor (ESA). Faculty advisors are there to give general advice but can't directly help. The ESO is a student member in charge of making sure the electrical parts are both functional and safe during the event and must have some limited experience formal or informal while the ESA is a professional there to advise the team on the electrical systems during the making of the car. Multiple ESA's are possible and both them and the ESO must fill out forms to detail their experience.

- Pre-Compitition Submisions (PS)

These are all about the documents needed for registration, how to format them in our submission and penalties for handing them in late:

submission	refer to	required form	Submit in file format	Penalty group
Structural Equivalency Spreadsheet (SES) as applicable to your design	**F.2.1**	see below	XLSX	Tech
ETC - Notice of Intent	**IC.4.2**	see below	PDF	ETC
ETC – Systems Form (ETCSF)	**IC.4.2**	see below	XLSX	ETC
EV – Electrical Systems	**AD.5.2, AD.5.3**	see below	PDF	Tech

Officer and Electrical Systems Advisor Form				
EV - Electrical System Form (ESF)	**EV.2.1**	see below	XLSX	Tech
Presentation (if required, see **S.2.4.1**)	**S.2.4**	see **S.2.4**	see **S.2.4**	Other
Cost Report	**S.3.4**	see **S.3.4.2**	(1)	Other
Cost Addendum	**S.3.7**	see below	see **S.3.7**	none
Design Briefing	**S.4.3**	see below	PDF	Other
Vehicle Drawings	**S.4.4**	see **S.4.4.1**	PDF	Other
Design Spec Sheet	**S.4.5**	see below	XLSX	Other

Format: Use the template file or form available on the Event Website

Note (1): Refer to the Event Website for submission requirements

Penalty group, per 24h:

ETC	none	Not Approved to use ETC - see **PS.3.4.1**
Tech	-20	**Grounds for Removal** - see **PS.3.3**
Other	-20	Removed from Cost/Design/Presentation Event and Score 0 points – see **PS.3.2.2**

- Vehicle Requirements (V)

How the car should look: configuration, driver, suspension/steering and wheels/tires.

- Chassis and Structure (F)

Includes: definitions, documentation, materials, chassis, tube frames, monocoque, front chassis protection, tractive battery container, tractive system. Dimensions (F.5.6.5 - F.5.6.6)

- Technical Asppects (S)

Includes: cockpit, brakes, electronic throttle, powertrain, preassurized systems, bodywork and aerodynamic devices, electrical equipment.

- Vehicle and Driver Equipment (VE)

Includes: vehicle identification, vehicle equipment, driver equipment.

- Internal Combustion Engine Vehicals (IC)

N/A

- Electrical Vehicals (EV)

Includes: definitions, documentation, eletrical limitations, components, energy storage, electrical system, shutdown system, charger requirements, vehicle operations, event site activities, red car condition.

- Technical Inspection (IN)

The car has to be inspected to make sure all parts are within regulation and the car can be inspected at any time. The steps are: initial inspection/gear check, tractive battery pack and charger inspection, mechanical/eletrical inspection, driver template inspection, cockpit template inspection, driver cockpit checks, active inspection/EV active, tilt test, rain test, brake test.

- Static Events (S)

There are 3 static events: presentation event, cost and manufacturing event and the design event. Design event is a presentation to summerize the building of the car, cost event is a report that summerizes the costs to make the prototype, materials, tooling etc. and the presentation event is a pitch to a hypothetical sponsor to get them to invest in a prototype.
Formula SAE

- Dynamic Events (D)

There are 6 events: acceleration event, skidpad event, autocross event, endurance event, efficiency event and post endurance.

Suspension system – Hyolin Eom

Overview

A suspension system is a structure closely related to the wheels of the vehicle that is designed to resist and allow recovery from unexpected impacts and uneven roads. It is also essential to let the driver have stable control and handling over the car in any environment

About suspension system

The suspension system is placed between the wheels and the chassis. It also has the function to connect those two parts. A suspension system is composed of three main components :

Spring - to allow retraction and replacement of wheels at impacts
Dampers(Shock absorber) - to absorb the energy transferred to the wheel to prevent its effect to the chassis
Linkage – the structure that connects the wheel and chassis also has the role of a guide the perpendicular movement of the wheel when retracting.

A suspension system would connect all the wheels to the chassis. The system, however, may vary in forms depending on the vehicle. The suspension system can be classified to two types depending on the impact of the movement of one wheel to another: independent and dependent. As you can assume independent suspension system allows each wheel to move independently without any effect to another wheel and dependent usually have a solid beam connecting the wheel from one side to another which results in the retraction of one side to move the opposite wheel. The independent suspension system lets a much more confortable drive because the impact is minimized and the handling is easier. These characteristics makes this system optimal for modern passenger cars. On the other hand, the dependent system is used in trucks due to its high durability and cost effectiveness. For an Formula SAE car where the vehicle is generally lighter and needs precise controls from time to time, the independent system is used.

There are a several different suspension structure such as : macpherson strut, double wishbone, multi link suspension, air suspension, hydraulic suspension, electronic suspension, and coil spring suspension. Those types all have their pros and cons, however for an FSAE car the double wishbone seems to be very popular in reason of its capacity to adjust. The double wishbone suspension system is composed to 2 control arm one on the upper side and another at the lower side in a form of a wishbone. The one on the upper side is made shorter to react better in corners.The wishbones are connected to the wheel(steering nuckle more precisely) with ball joints that allows its movement to all directions. At the moment of impact, the spring and dampers placed in either control arm depending on design reacts to prevent energy transmission to chassis and to keep the wheels on the ground. An anti roll bar is also placed from one side of the independent suspension to the opposite side to reduce body lean.

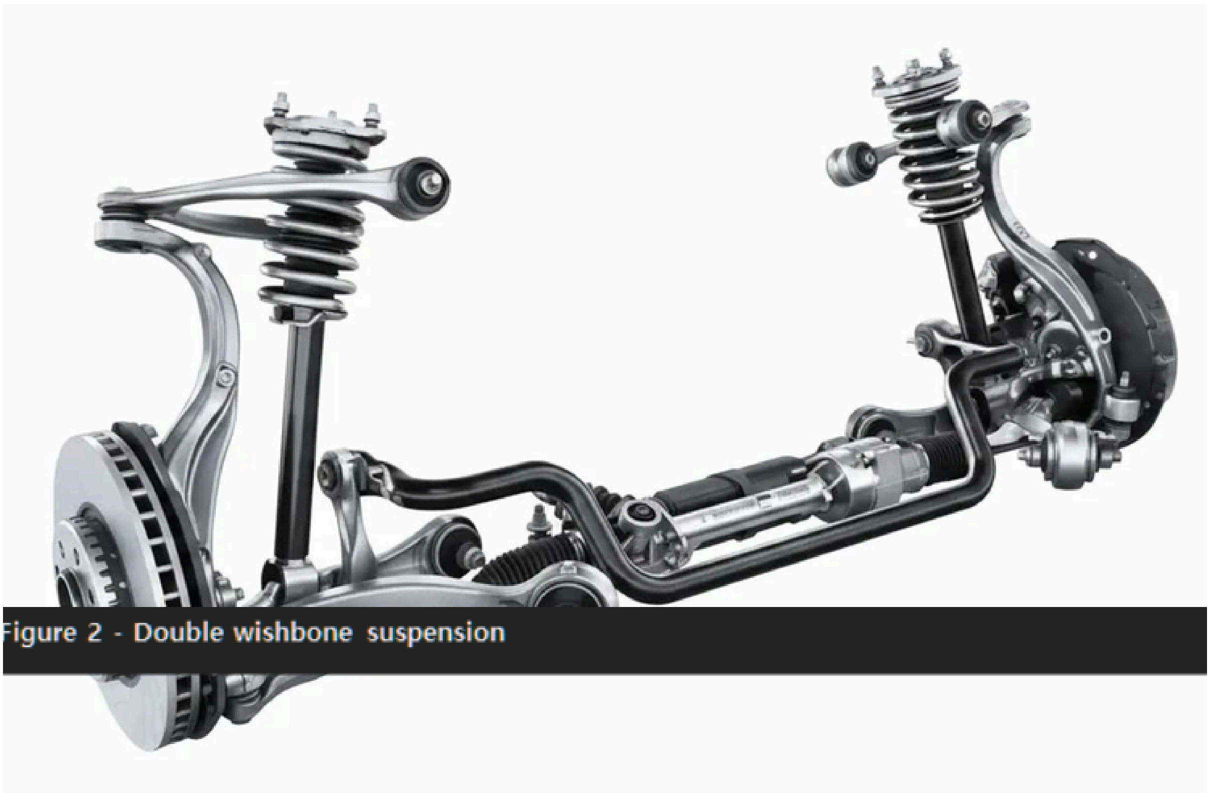


Figure 2 - Double wishbone suspension

https://youtube.com/shorts/VpkTwG7FSQ4?si=oznHa7y5GhWF-IHZ

FSAE regulation

The following pictures are the regulations on the suspension system from the official rulebook

Figure 1- Page 73(Formula SAE rulebook 2026)

Figure 2_- Page 20(Formula SAE rulebook 2026)

How we would build it

To finally build the suspension system we would have to analyze the expected loads, size, and type of other components(such as tire). Then, we could start designing the structure of the suspension system with 3d modeling tools such as Fusion360, Inventor, and SolidWorks. The engineering drawing of the final design of the parts can be done with software such as AutoCAD. The engineering drawing with bill of material should optimistically be done before ordering any materials. The design of the linkage and the overall system must be designed with other teams to fit the mechanism well. Using the predicted specs and overall design, we can find the matching standard springs and dampers using decision matrix. For the linkage, we would have to first choose the right material based on the costs and qualities for each part. Then we have to reshape them using mills and lathe. This process can also be done with CNC machining. After that we would have to connect those metals using welding or other techniques to make the parts like control arms.Then, we can connect all the parts with hardwears.

Cost

The cost of suspension system of previous FSAE teams ranges from 2000 to 3500 USD dollars.

The most expensive part seems to be dampers which range from 50 to 700 USD according to McMaster-Carr. In the cost reports from other FSAE teams the dampers were around 250 to 350 USD each so we would have to expect around 1200 USD, so around **1700** CAD just for the dampers. A coil spring seems to be 20 to 40 each,so that would be **120.** Then we would need Then we would need some small components such as bolts, nuts, bushing, spacers, rocker, and washers that would be approximately **300**.The push rods/pull rods are round 35 dollars according to the other team from 2023, so it would be around **160**.The 4130 steel for anti roll bar is approximately **170**.The control arm needs 2 steel tube for each,so it would be around **800**.The other components for connections would be approximately **600** so the total would be around 3800+tax.However this does not count the machining fee, so we would have to see it as about 4500 for suspension. This is an approximative value assumed with the cost reports of previous teams from other schools (and not with actual analyze of our design), so the actual price might be lower.

Possible supply source

The hardwears can be found on Home Depot or Rona+. There is some steel/aluminum tube and sheet from canadian tire with unknown features. The coil springs and some other components can also be found in canadian tire. However, it would be better to find a store that sells raw metals.

Conclusion

Suspension is an extremely important part of the car with several components that have to be carefully chosen considering all the needed features. It is hard to assume much thing right now without much analyze and experiences. I hope it gets better through the preparation process.

Bibliographie

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https://www.jdpower.com/cars/shopping-guides/what-is-the-suspension-in-a-car

https://www.intraxracing.nl/en/knowledgebase/what-is-suspension-on-a-car/

https://www.reddit.com/r/FSAE/comments/dn5h3v/suspension_types/

https://myigetit.com/tech/independent-wheel-suspension/
https://www.spinny.com/blog/types-of-suspensions/

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https://contest.techbriefs.com/2017/entries/automotive-transportation/8206-0630-092501-design-analysis-and-fabrication-of-double-wishbone-suspension-system-for-a-hybrid-cycle#:~:text=Upright%20is%20designed%2C%20fabricated%20and,of%20toughness%2C%20strength%20and%20ductility.

https://youtu.be/ExIxOjBCa5w?si=Lc-i-gVRZk5yedu2

https://shautoparts.com/glossary/double-wishbone-suspension-system/

https://www.facebook.com/share/14imqh3qizH/

https://youtu.be/rRtGxJSCGCI?si=L0zwe9nKbkrYazaR

Cost reports from previous teams

https://www.fsaeonline.com/content/Sample-FSAE-Cost-UV23-NoDrawings.pdf

https://blogs.dal.ca/formulaSAE/files/2012/04/Untitled-Extract-Pages.pdf

https://www.fsaeonline.com/content/E217_University_of_Akron_FSAEE_CR_Supplement(rev2).pdf

https://www.fsaeonline.com/content/cornell_combined_redacted.pdf

All accesed on 07/14

Chassis - Anthony Murgante

The following is a summary of the structural parameters required to design and make a chassis for a formula SAE car. The main goal of these regulations is to guarantee driver safety while optimizing the structure, stiffness, weight, and layout of the car. Firstly, it is essential to establish the strict baseline material properties and geometric bounds imposed by the Formula SAE Rules.

1. Material Baseline Standard space frame construction relies on mild steel or alloy steel tubing (such as 4130 chromoly). The rules dictate a baseline Young's Modulus (E) of

200 GPa, a minimum yield strength (Sy) of 305 GPa, and an ultimate strength (Su) of 365 GPa for non-welded calculations.

2. Structural Minimums To be counted as structural in the required Structural Equivalency Spreadsheet (SES), primary tubing must meet specific dimensional criteria, generally avoiding any wall thickness under 1.2 mm. Non-structural members falling below these limits are entirely ignored during official compliance checks.
3. Components Clearance The primary structure must provide adequate clearance to accommodate critical subcomponents like the tractive battery, suspension nodes, and the driver cockpit templates safely within the protected zone. It is acceptable (though technically challenging and highly labor-intensive) to utilize an advanced composite monocoque instead of a space frame. However, as a rookie team, a hybrid or full composite structure may not be wise. Monocoques necessitate extensive physical material coupon testing to prove equivalence to the standard steel baseline in terms of energy dissipation, bending, buckling, and tension. This adds significant financial overhead and testing complexity, which is why sticking to a traditional steel space frame is highly recommended for an inexperienced team. In multiple public forums, designing a high-density, fully triangulated space frame layout is recommended to yield predictable torsion paths and easy suspension hardpoint optimization. It conforms directly to standard rules without requiring proprietary manufacturing molds. For reference materials and compliance tracking, the Design Judges Portal remains one of the best public assets. It details recent critical frame updates, including the phase-out of side view tubes and strict rules dictating that the rear bulkhead must stand fully vertical to its required height.

Drivetrain system – Jean-Roger Caron-Ma

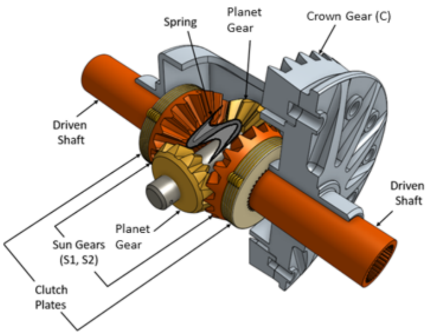
Dawson Aerospace Club Formula SAE Team

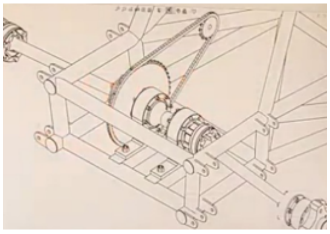
Overview

The drivetrain of the vehicle transfers power from the motor or motors to the wheels. The transmission is a component of certain drivetrains that allows the operator to select how much motor power is transferred to the wheels. The transmission may or may not need to exist: if the motor or motors provide the torque and speed desired without a transmission, one should not be implemented to reduce weight and complexity; however, if the motor or motors do not, the transmission is required.

Mechanisms of the drivetrain

The drivetrain must minimally contain a mechanical line from the motor to the wheels. If several motors are used, then each motor is connected to a fraction of the total wheels of the vehicle. To facilitate the connection to the wheels with a limited number of motors, a differential is typically used, which allows for the efficient connection of a motor to two wheels simultaneously, whilst controlling for a fixed ratio at which power is to be transferred. A **limited-slip differential** is the ideal choice for efficient turns and in cases of wheel slippage, as power be variably transferred across both wheels of the axle and power will not be lost if a wheel slips. However, such a system is complex and probably outside the scope of the project. The physical line could otherwise be as simple as a **chain-and-sprocket system** linking the motor to the differential. Such a system would be cheap to implement.





Is the transmission necessary?

As the vehicle is an electric vehicle, with electric motors whose effective RPM range should allow for adequate torque and speed, a transmission is not required. A static gear ratio may be enough for our purposes. The aforementioned systems for drivetrains could allow for a static gear ratio.

The Cheap and Easy Solution is disregarding a transmission and have the electric motor connected to a differential using a chain-and-sprocket system.

Building it

According to the Rules, the drivetrain must be made of solid material. Ideally, this would require the use of **subtractive manufacturing**, since a system built from a 3D printer, for example, could certainly not withstand the forces it would be subject to. The differential would be machined out whole, including the sprocket that would be part of it. However (detailed in *How expensive are we talking?*), the cost in that case may be astronomical, so using solid off-the-shelf components may be more alluring, as that would allow us to cheaply manufacture prototypes, and as long as the material is solid and not perforated, such a system could be adequate for our purposes. This means that the specific gear ratio would have to be figured out before manufacturing. This depends on the motor and the speeds we seek to achieve. In other words, the design considerations of the drivetrain rest on other parts of the vehicle. Once the specifications are decided, a form of subtractive manufacturing, such as **CNC machining** would ideally be used to produce the differential or differentials compatible with a desired chain. Otherwise, off-the-shelf parts could be found and then assembled in a working design. A sprocket may also be manufactured or otherwise acquired that connects to the motor. Furthermore, a scatter shield must be implemented in the case of catastrophic failure of the system to prevent user damage. The component must also be isolated from any other component to protect said components. The rotating part of the electric motor must also be individually isolated in a structural casing. A cooling system must be completely sealed as well.

How expensive are we talking?

Commercial costs can easily be thousands of dollars that we really do not have. Seeking subsidised access to a miller/machine—like what is offered to students in schools—is paramount. Such a deal would greatly reduce costs. Off-the-shelf solutions would probably cost no more than a few hundred dollars, but it is less fun and potentially less resilient, effective or stable. Alas, with very shallow pockets, compromises must be made. Prototyping with CNC is certainly unfeasible, and making a final design with CNC is expensive and could probably be avoided.

Conclusion

The drivetrain can be extremely simple, which is what we need as we are regrettably a team without much experience or money. The most cost-effective and still very functional choice is a differential connected to the wheels, which is connected by chain and sprocket to the motor. The considerations of the design must be figured out in tandem with the rest of the components, as the drivetrain is integral to the operation of the vehicle and its design rests on the design of other components. Only then, is the system manufactured. Prototypes may be done primitively but laid out in the *Building it* section are the requirements for competition.

Sources

FSAE Rules; see section T.5 starting page 67.
FSAE Drivetrain explanatory video

Wheels - Nicholas Tirschler

Introduction

Wheels and tires are an often overlooked part of a car. Yet they are often the deciding factor in winning and losing races. They are the only way for the car to interact with the ground (hopefully) and thus must translate all mechanical inputs into traction.

Cost

Aluminium wheels might cost us ~$500 while good tires would likely be ~$1100. If we add another $100 for mounting supplies/hardware. All-in, $1700 for the full system.

Sources

https://keizerwheels.com/product-category/fsae/
Best option:
https://hoosiertirewest.com/categories/circuit-racing-road-course-rally/formula-student-fsae.html

Brakes – Sophia Ross

Overview

The brakes in a Formula SAE car are essential for the safety of the driver and other vehicles on the racetrack. In order for the brakes to be effective, the driver must be able to feel the front-tire grip under deceleration, it must provide strong, predictable braking at high speeds while remaining controllable at low speeds, and it must withstand the strong thermal and mechanical loads during hard braking.

Brakes As I Understand Them

A basic brake system uses a **brake pedal** which pushes on the **master cylinders** that pressurizes brake fluid, sending it through **brake lines** to the **calipers** which clamp the **pads** onto the **rotors** to slow the wheels.

Brake pedal: provides the driver's input, self-explanatory.
Master cylinders: converts pedal motion into hydraulic pressure, FSAE requires two independent circuits.
Brake line: carries hydraulic pressure to the calipers; must be armored and non-plastic.
Calipers: uses hydraulic pressure to clamp the brake pads onto the rotor.
Pads: creates friction against the rotor surface to slow the car.
Rotors: dissipates kinetic energy as heat during braking.

How we would build it

Now that the basic components of the braking system have been selected, here is how we would construct the full assembly from scratch. The first step is determining the engineering requirements: how much braking torque the vehicle needs, the expected deceleration, weight transfer under braking and the required hydraulic pressure. Once these constraints are known, we can design each subsystem to meet FSAE safety and performance standards.

This brake system is composed of several subsystems and the most efficient approach is to build each one individually before integrating them into the chassis. The pedal box comes first. We would mount the aluminum brake pedal inside a custom pedal assembly, likely CNC-machined from aluminum for strength and weight reduction. The dual master cylinder attaches directly to the pedal. Next is the hydraulic system. The brake lines would be routed along the chassis. Once the lines are secured, they connect to the master cylinders and run out to each wheel.

The final subsystem is the braking hardware at the wheels. The rotors mount to the hubs and require us to machine custom rotor hats. The calipers attach using CNC-machined brackets designed to position them correctly over the rotor. After installing the brake pads, we would bleed the hydraulic system.

Cost

The braking system consists of several commercial components, each contributing to the total cost of the build:

- Wilwood dual master cylinder ~$360
- Wilwood aluminum brake pedal ~$160
- Stop Shop brake lines ~$65
- Wilwood calipers ~$260
- Wilwood brake ~$90
- Summit brake rotors ~$75

Total for major components: ~$1,010

Additional costs include machining brackets for the pedal box ($100-$200), mounting hardware ($40-$80) and brake fluid plus bleeding supplies ($20-$40). Altogether, a realistic budget for this brake system is $1,170-$1,330, which ensures all components are properly mounted, tested and competition-legal.

Conclusion

The brake system is made of simple, well-defined subsystems and all the components are easy to assemble with basic machining and careful setup. This is absolutely something we could build at school without needing a full workshop. With a budget of around $1,200, the project is realistic, manageable and a good opportunity for newer team members to get hands-on experience with FSAE mechanical systems.

Sources

For any reference to the rules: FSAE 2026 Rules pages 64-65
Shop (wilwood dual master cylinder)
Shop (wilwood aluminum brake pedal)
Shop (the stop shop brake lines)
Shop (wilwood calipers)
Shop (wilwood brake pads)
Shop (summit brake rotors)
Basic Brake System Article

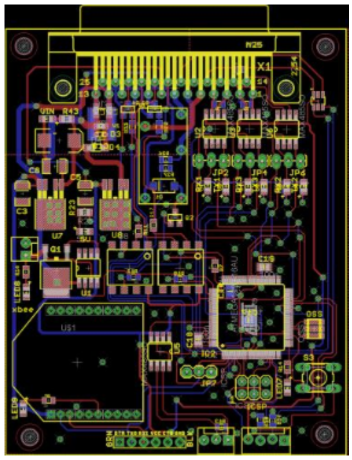
Electric system - Phill Yaden Edzang

Overview

The electrical system of a Formula SAE car powers the vehicle and engine controls. It allows the engine to start, regulate, and stop the motor running for everything. The system distributes electrical power from the battery to all low-voltage devices, collects sensor information, communicates between electronic modules through a Controller Area Network (CAN), and allows the driver to safely operate the vehicle.

The system can be separated into 2 pathways: low and high voltage. Low-voltage system drags power from the battery to supply the electronic control unit (ECU), for example a battery management system which is required to monitor a battery pack, shutdown circuits and sensors (e.g, VSS). Communication between electronic devices occurs through a Controller Area Network (CAN), reducing wiring complexity while increasing reliability.

Examples of instances of ECU for a FSAE electric car:



ECU acts as the vehicle's central nervous system, replacing traditional mechanical linkages with real-time, algorithmic decision-making. By constantly processing data and driving physical actuators, the ECU unlocks levels of performance, reliability, and tuning accuracy that purely mechanical systems simply cannot match.

The ECU receives analog or digital electrical signals from a vast network of sensors measuring real-time physical variables (e.g., engine speed, fluid temperatures, and pressures). The ECU receives analog or digital electrical signals from a vast network of sensors measuring real-time physical variables (e.g., engine speed, fluid temperatures, and pressures). Based on these calculations, the ECU instantly sends commands to crucial vehicle systems (e.g, electronic throttle sensors).

Requirements

The FSAE regulations outline the mandatory technical standards for the Tractive System (TS) design. The primary focus of these regulations is to ensure operator and handler safety through robust physical barriers, reliable insulation, proper wire sizing, and high-visibility physical protection of high-voltage lines.

- Rigid, secure, and nonconductive covers or materials must enclose all TS components. Standard removable vehicle bodywork is explicitly prohibited from acting as a primary TS enclosure.
- Enclosures must be designed such that a 100 mm long, 6 mm diameter insulated test probe cannot make contact with any TS connection when the covers are fully installed.
- All primary insulation materials must have a minimum continuous operating temperature rating of 90 degrees Celsius.
- All wires, terminals, and conductors within the TS must be physically sized to safely handle the maximum continuous current they will conduct

Sources:

For any reference to the rules: FSAE 2026 Rules
https://www.researchgate.net/profile/Kala-Meah/publication/334894678_Design_and_Implementation_of_a_Drivetrain_for_an_FSAE_Electric_Vehicle/links/64b04db1b9ed6874a5181e1a/Design-and-Implementation-of-a-Drivetrain-for-an-FSAE-Electric-Vehicle.pdf
https://www.secs.oakland.edu/~ganesan/old/courses/SYS595%20F06/CAR%20ECU_development7%20.pdf

Conclusion

A fully compliant formula SAE car is an extremely complex and precise endeavour. We believe the only way to progress through such a massive task is to split it up into subsystems and tackle them individually and in parallel. As it stands, the main costs of the project can be broken down as follows (All in Canadian Dollars):

Steering : ~$600
Engine (Motor + Inverter) : ~$14,000
Suspension System : ~$2000
Chassis : ~$2000
Drivetrain : ~$500
Wheels : ~$1700
Brakes : ~$1300

In order of importance for build order, they are: Chassis, Suspension, Steering, Brakes, Drivetrain, Engine, and Wheels. This means, in case of limiting funding, we could build the Chassis, Suspension, Steering, and Drivetrain this year and leave the rest for another. This is the most likely scenario. If, for example, we only had $5000 to work with for the year, we could build the chassis, suspension and brakes which would definitely keep us busy for the year. Then the following year we might build the drivetrain, steering, wheels and an airfoil. Then in the final push we would have to find a sponsor willing to pay for the final part of our car.