Freshmen Summer Internship Program 2013

Assignment 1

Topic: Chassis and Tractive System

- Teams of 2
- This assignment is divided into four parts – A Chassis (Basic) B Chassis (Advanced) C Tractive system (Basic) and D Tractive system (Advanced)
- Everyone has to attempt both the basic sections (A&C)
- Everyone has to attempt advance section (B or D) of their subsystem; i.e. Mechanical guy has to attempt advanced mechanical section (B) and electrical guy has to attempt advanced electrical section (D)
- If you wish to attempt another advanced section as well, no one's stopping you. But, that shall be acknowledged and encouraged only if you do justice with your subsystem
- While we seriously encourage healthy discussions we do condemn plagiarism (copying). Come on man! we work so hard designing these assignments to teach you. Don't do this to us !!
- Feel free to approach any senior any time of the day – for queries, doubts or trash talk we are always open.
- Don't forget to list the references at the end of your assignment
- Keep in mind that an image is worth thousand words
- Enjoy your assignment!!

Submission deadline – 11:59 PM, 10/5/2013

Section A Chassis (Basic)

1. Chassis
   What?
   Why?
   How? (Types and materials)
2. Define
   Bending
   Buckling
   Torsion
   Compression and
   Tension
3. Which failure mode(s) identified above will concern you the most while designing
   - 2 force member, say tie rod
   - A seat belt clamp or suspension clamp
   - Shafts

   **Feel free to shake a senior and ask him to show you these parts on the car.*

5. "T3.10.1 The driver's head and hands must not contact the ground in any rollover attitude."– Ref FS 2013 rulebook. Look at the car and check whether we have followed this rule. If yes, how? Explain sketching a rough diagram.

Section B Chassis (Advanced)

1. Based on your session on torsion setup , answer the following questions

a. I BEAM, What why and how?

b. If we wish to calculate torsional rigidity of chassis, why are we applying load at the wheel hubs and not directly at the suspension points?

c. Draw a rough schematic of the torsional rigidity setup. Clearly indicate the positions of the sensors and the actuators

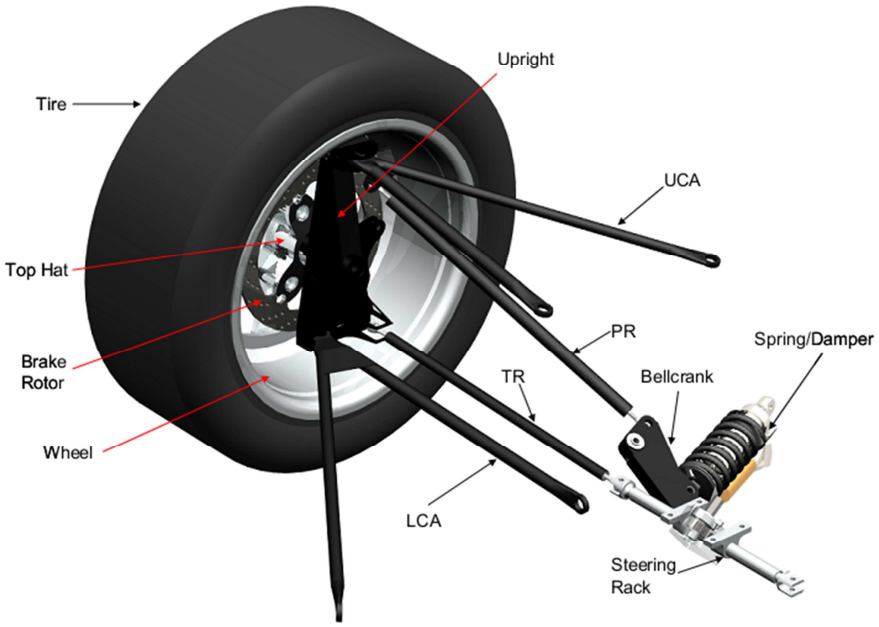
d. On application of 44.1 kg of load

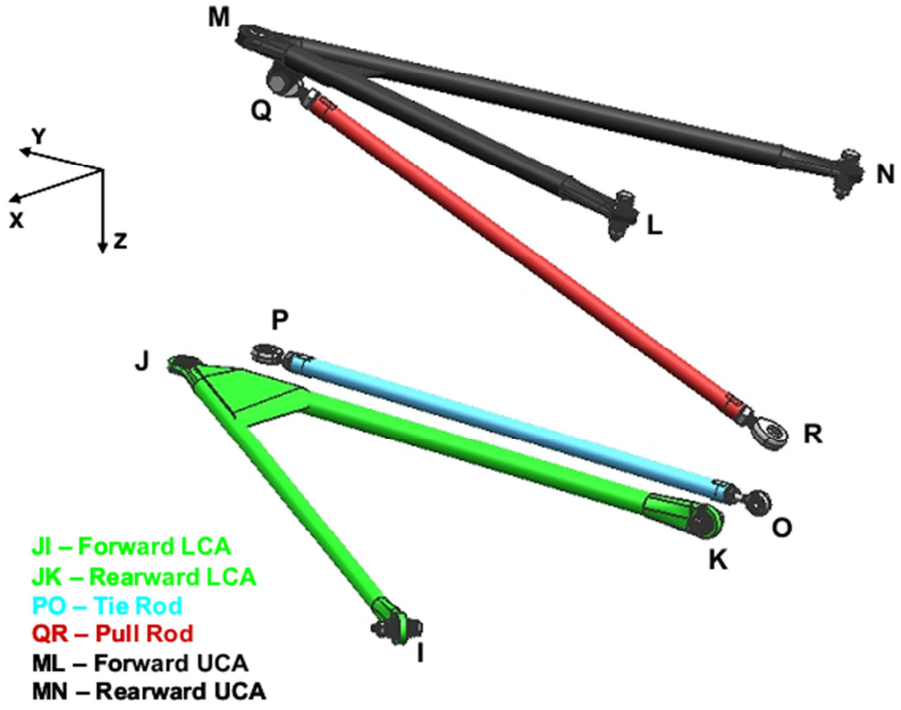
   a. dial gauge on pivot : 0.98 mm
   b. dial gauge at the hub: 6.44 mm

   Calculate the torsional stiffness of the chassis. (Moment arm = 1.08 m, distance between hub and pivot = 0.71 m). Check whether these values are realistic.

e. What is the major assumption in the above calculation? How will stiffness value change if your assumption is not considered?

2 You wish to calculate forces at the suspension points in case of "5g bump". But damn!! Suspension designer is lazy and has given you just the tire print forces.





All units mm		Start			End		
Member		X	Y	Z	X	Y	Z
FLCA	J-I	940.5	571.5	-149.9	1282.7	133.4	0.0
	J-K	940.5	571.5	-149.9	940.5	133.4	0.0
FUCA	M-L	914.5	539.4	-378.5	914.5	230.7	-317.6
	M-N	914.5	539.4	-378.5	661.7	230.7	-292.1
FTR	P-O	880.8	548.3	-149.9	880.8	133.4	-127.8
FPR	Q-R	908.9	520.4	-352.9	790.1	191.7	-143.4
Wheel Center		935.4	609.6	-254.0			

Tire print forces – Fx =Fy=Mx=My=Mz=0 ;Fz = -3009 N.

*Suggestion : You might like to use MATLAB here.

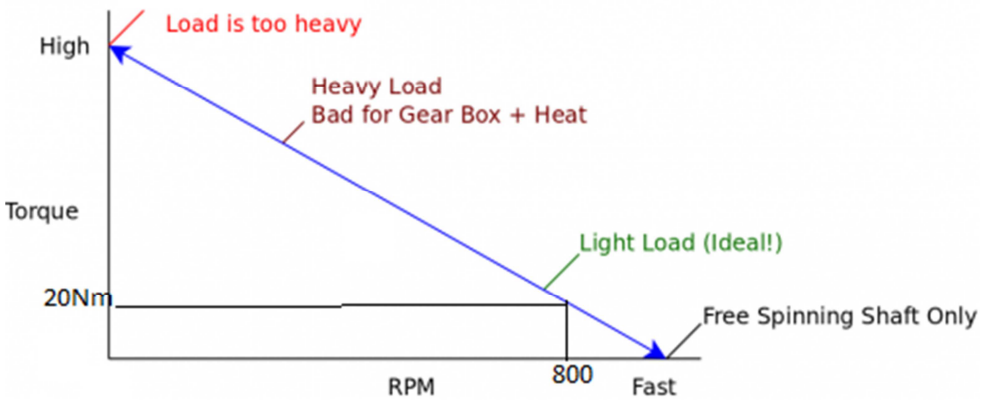
Bonus Question : Generate a code that gives out force values in each linkage for any Fx,Fy,Fz,Mx,My,Mz input.

Section C Tractive system(Basic Questions)

1. What is tractive system?
2. Difference between LV and HV?
3. Different types of motors and which one will be good for EVo3.0?
4. What is BMS (Battery management System) and list appliances which have BMS in it?
5. *"EV4.8.1 It must be possible to disconnect at least one pole of the tractive system accumulator by quickly removing an unobstructed and directly accessible element, fuse or connector, in case of (a) stuck accumulator isolation relay(s) for example. It must be possible to disconnect the HVD without removing any bodywork."– Ref. FSAE rulebook 2013.*
   In context with the above rule, what is HVD? How we can do it?
6. What are risks involved working with Li-Po batteries? How this risk is mitigated in EVo 2?

Section D (Advanced Questions)

1. What are different parts of battery system?
2. Rule:- You have to control HV using LV system but there is rule that HV and LV side should be physical separation of 10 mm, so what do you think how we can do and justify your choice? (Hint: Diode, MOSFET, BJT, Relays, Contactors, etc. – they all work as switches)
3. Functions of BMS?
4. What are possible errors given by BMS that we should take care for battery safety?
5. Simple working of permanent magnet DC motor?
6. L293D which is used for controlling motor, Explain how it is controlling with complete circuit? (Hint: You have used this in your XLR8 bot.)
7. Function of brushes in DC motor and what do you think how it works in brushless DC motor?
8. Suppose you have: 20 cells, each cell of 60Ah and maximum current of 120A with voltage 4.2V when fully charged and 3.7V nominal voltage, load is the motor of power rating 20kW with maximum operating voltage 37V and T-w characteristics are shown below as shown figure below if motor is operating at the given point. Find the battery configuration and the time for which it will last.



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