

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 5

LEFEL 5

EXAMINATION PERIOD
MAY 2016

CYFNOD ARHOLIADAU
MAI 2016

MODULE CODE: M5X00402
Motorcycle Dynamics

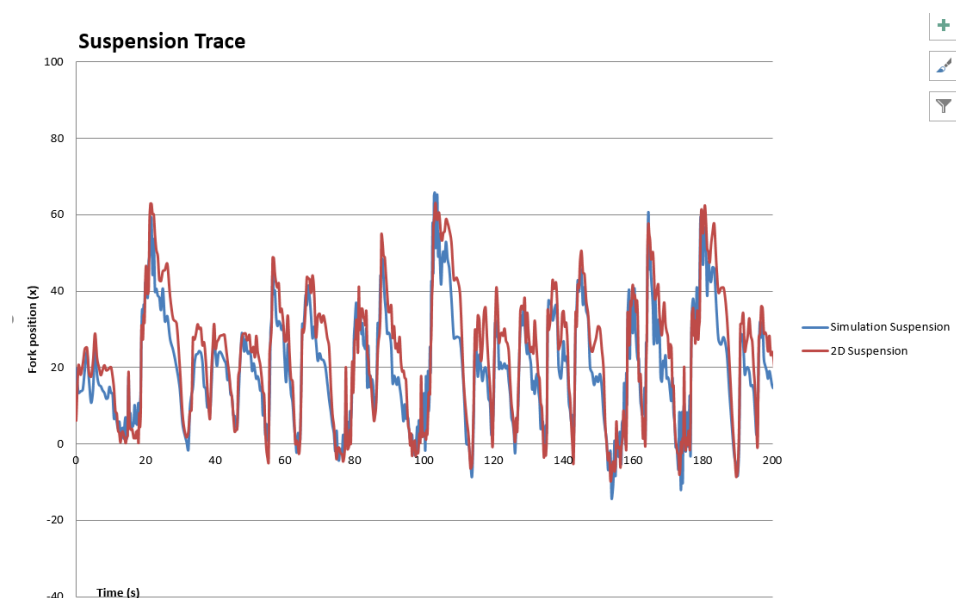
TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Non Programmable Calculator

ANSWER ALL QUESTIONS

1. Considering that wheel velocities and suspension measurement are an integral part of any modern data & control system, describe what precautions have to be made when utilizing the raw data from these sensors, especially if being used for traction or launch control? (5 marks)
2. Explain what extra sensors might be required on a modern MotoGP bike and how they would be implemented in modern control system to make the bike both faster and safer. (5 marks)
3. Shown below is a comparison between ‘simulated, using wheel velocity as a start point’ and ‘measured suspension data’ for the BlataWCM MotoGP bike. Explain in detail how the simulated trace is generated and how it can be used. (10 marks)

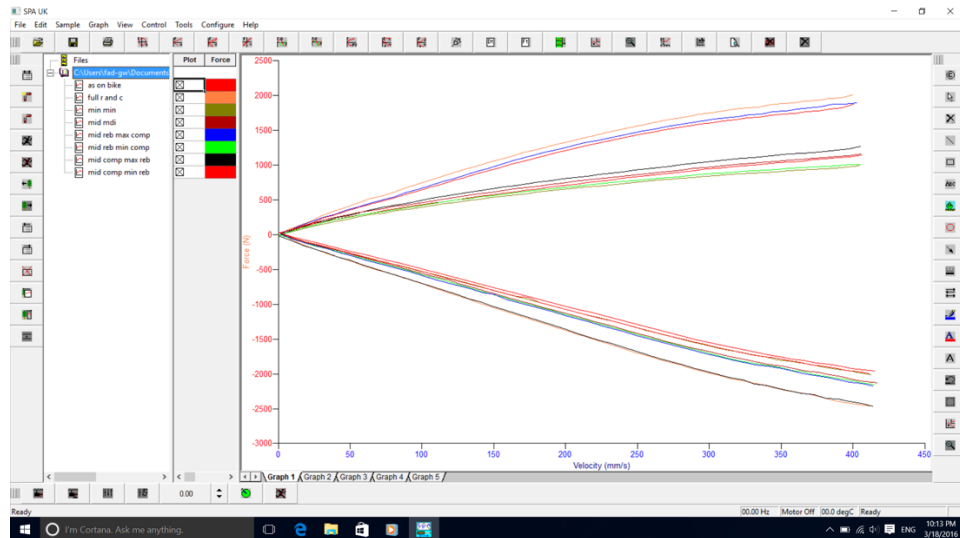


4. The Mahindra Moto3 bike has the following specifications:
Total mass – 78kg
CofG bias – 60% front
Front un-sprung mass – 6kg
Rear un-sprung mass – 9.2kg
Rear link ratio – 2.35 (average)
Rake angle – 21.2 degrees

Using your knowledge of suspension design, determine the required spring rates for the shocks and forks and the appropriate damping for a 70kg rider. (15 marks)

5. Shown below is the suspension data for the standard rear shock from a CBR600RR, re-valved and setup by K-Tech. There are a number of factors that you can see in the graphs that you would not expect in an expensive, dedicated, aftermarket race shock.

Sketch a graph of how you would expect the data to look for an expensive aftermarket shock absorber and what important factors you would expect to differentiate it from a cheaper standard unit? (10 Marks)



6. Explain in detail how a gyroscope works and how it is used to control the steering of a motorcycle (5 marks)
7. In steady state cornering, the gyroscopic torque due to the yaw rate of the motorcycle results in a torque acting about the roll axis of the motorcycle. Derive an equation that allows you to use this torque to determine how the lean angle or the displacement of the riders mass must be altered to maintain vehicle equilibrium. (10 marks)

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