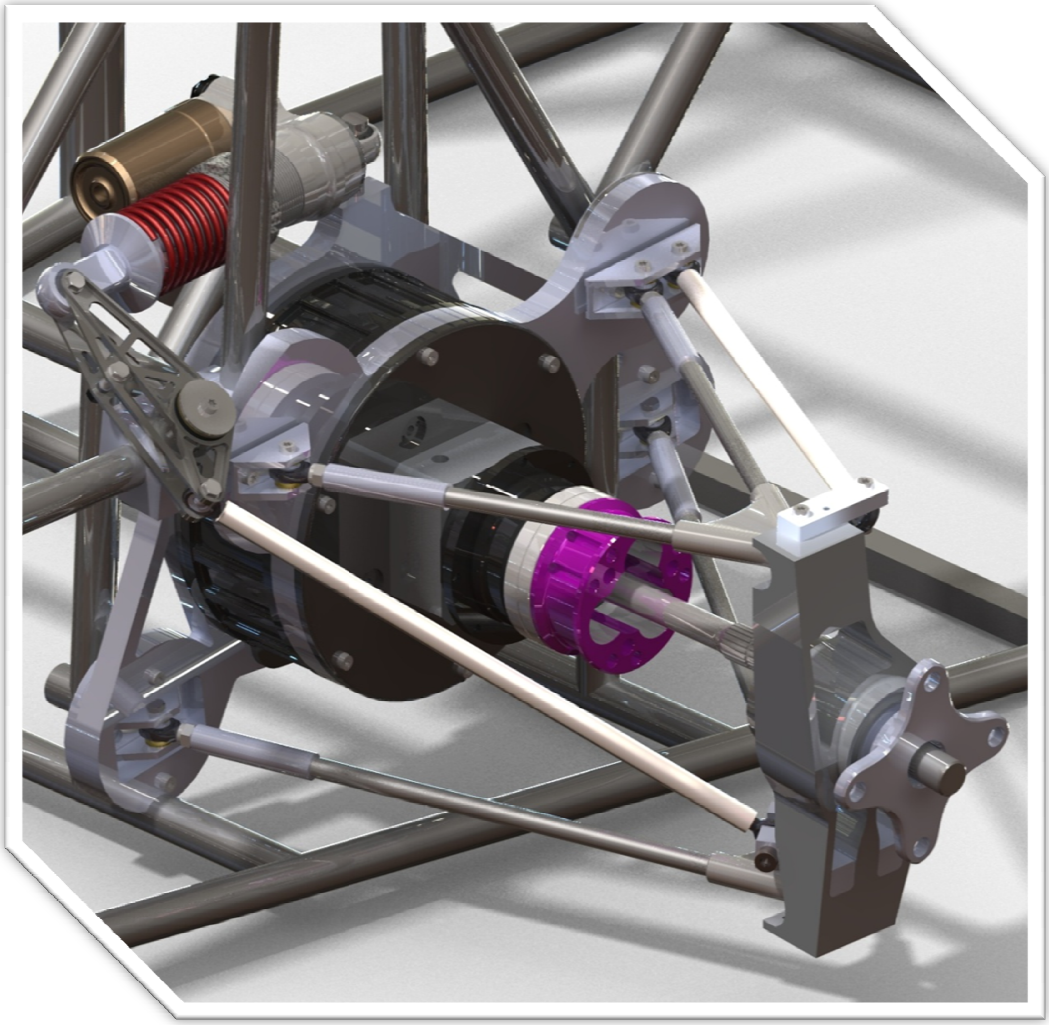
Suspension Calculations

‘Project Plan Report’



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12 November, 2009

Introduction

The idea for this project stems from my experience with the Imperial Racing Green organisation in the third year, in which my team had the task to design, make and test the suspension system for a zero-emissions fuel cell race car. Each year members of the Racing Green project must perform similar suspension calculations as part of such projects. In some years this task has been carried out using Microsoft Excel, and in others using Matlab and C++. However, there is no standardised platform for calculating the forces on the suspension system, so each team ends up repeating the work of previous years. The principal aim of this project is to create an open-source calculator program that standardises this system, and combines the visual benefits of Excel with the programming aspect of Matlab and C++, using Microsoft Visual C# Express Edition. The language of Microsoft Visual C# has been chosen, as it is free, easily accessible, and widely familiar.

The program will not only allow ease of suspension calculations, but will also provide a teaching platform with diagrams and written explanations, to increase the understanding of the processes behind the results. An executable version will be available online, so that users can install and run the program. However, there will also be online access to the source code, so that the integrity of the calculations can be confirmed. Furthermore, this open-source nature of the program would allow others to add new features to what has already been completed. Some similar programs do already exist, such as CarSim, which provides accurate calculations. However, these are generally not free or open-source, which are the key features through which this project aims to distinguish itself.

Key Objectives

- To design, program and publish an executable program that carries out the following suspension calculations in SI and imperial units:
  - Static and dynamic wheel loads
  - Roll rates
  - Wishbone forces
  - Spring stiffness and dimensional properties
- Create information icons to inform users of what the fields they fill in refer to and to educate them on the principals used to calculate the values.
- Create a user-friendly website to allow global access to the executable version of the software and to make the source code available.
- Trial the software with a few online users and Imperial colleagues, to test the functionality and receive input on how to improve it.

Scope

The software application is designed to perform mathematical calculations, and will not include finite element analysis or assist with geometry setup. It is targeted for the university student race car market, in which projects normally use double wishbone suspension systems. Therefore, the scope of the calculations is limited to such configurations, and excludes active suspension systems.

The calculations will take into account any combination of the effects of accelerating, braking, cornering, banking, terrain, and aerodynamics. These effects will be used to calculate the forces in most components, including the wishbones, apexes, uprights, pushrod mount, springs, chassis, rocker and rocker mount. This will not include simple calculations, such as the ones needed for bearing or bolt selection, or the ones for components such as rims and tyres, that do not require precise mathematical calculations. The software will run in the English language and perform these computations for both SI and imperial units.

Personal Timetable

The weekly timetables in **Figure 1** show my schedules for the first two terms. In the first term, I aim to work 26 hours per week, due to having fewer subject deadlines and lectures, and 13 hours per week in the second term.

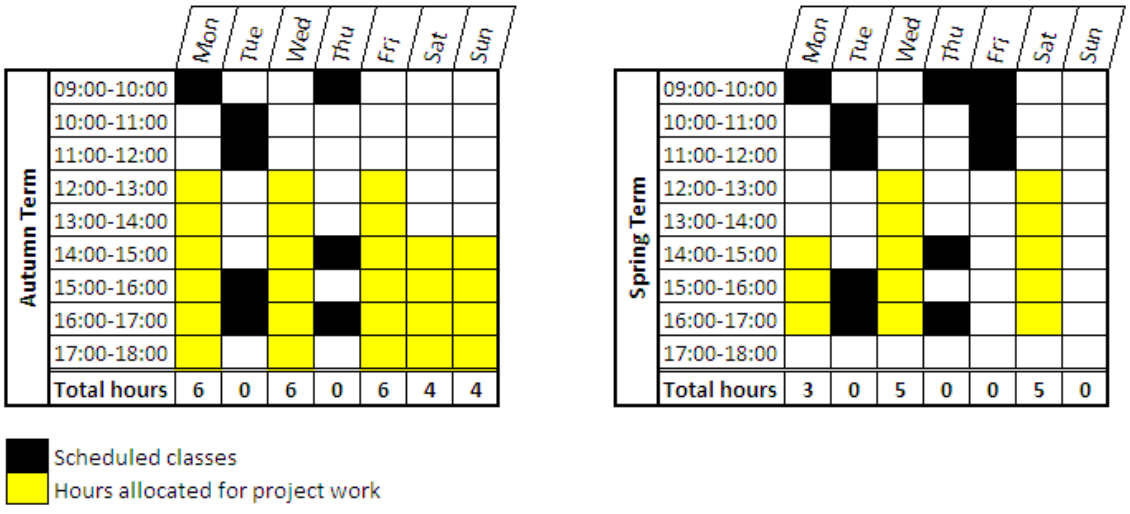

Figure 1: Personal Timetable

Project Plan

Figure 2 is a diagrammatic project plan, listing the main project milestones and reports. The aim is to complete the product in the first 2 terms, leaving the 2-3 post-exam weeks for the Final Report and Presentation. Meetings with my Supervisor Dr. Lowe will be scheduled and held on a weekly basis.

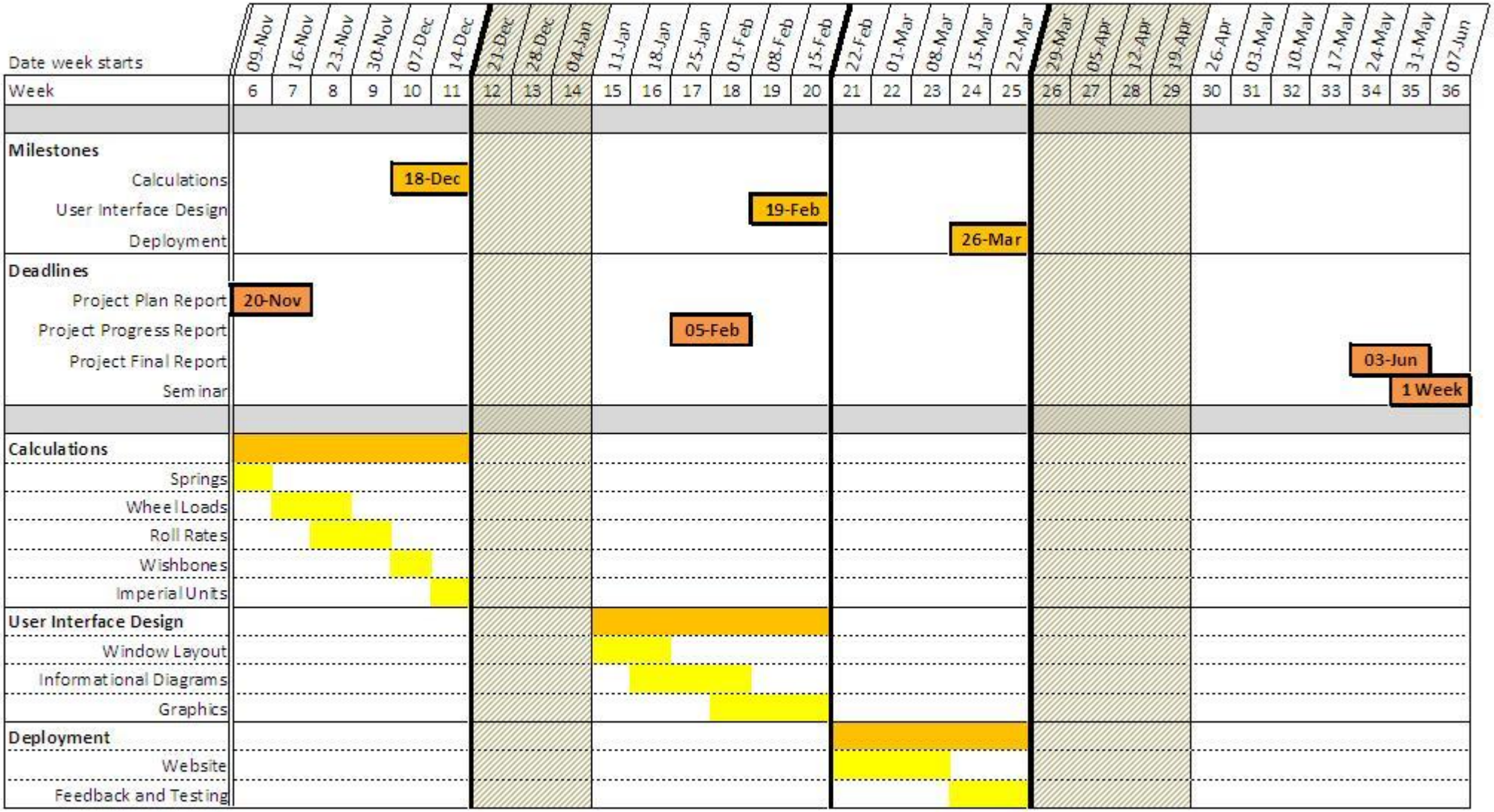

Figure 2: Project Plan Timeline