Outreach Activity – James Dyson Bursary

Designing and Manufacturing with Carbon Fibre Composites

Project title – Hybrid Carbon Fibre Composites for Automotive Applications

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Introduction

My project focused on advising and simplifying the design methods of composite pressure vessels for Formula Student teams, using the design of an intake plenum for the Cambridge Full Blue Racing as demonstration.

For the outreach activity, I decided to give an overview of Formula Student and engineering societies in University for which the students will know what to look forward to in a few years' time. Then I walked through the properties of composite materials and their design processes. Finally, I explained what I did in my project and how it would benefit FBR and the wider formula student sphere.

Session overview

1. ### Introductory of the FBR team

   I introduced the format of Formula Student and the structure of FBR, who we are and what we do. This gets the students to have an idea of what university societies are on offer and what societies do.

2. ### Explanation of carbon composites in vehicle production, with their pros demonstrated using sample material

   I gave a short explanation on what CFRP are and their benefits, and demonstrate their application in various vehicle parts. This give students a good idea of what is to taste in university materials course and how we apply material science to solve problems.

3. ### Description of difficulties in modelling carbon composites in pressure vessels, explanation of use of an intake plenum in vehicle

   I explained the orthotropic nature of CFRP, which is different from the isotropic materials students are more familiar with. I gave a short introduction about what Classical Laminate Theory is, and the difference in failure modes of the CFRP compared to classical materials. Students are allowed to look at failed samples from my project to see delamination and fibre breakage in real life.

   The use of intake plenums are introduced, and linked to why CFRP is the perfect candidate for their production.

4. ### Link my project to the base theory, explain the basics of my project and why I chose to undertake it

   I described briefly the underlying principles of my project and the testing that was carried out, giving the students a taste of what university lab work is like. They can get a gist of the analysis and thought process of converting theory and book work into real-life design.

5. ### Explain how the plenum is made, with demonstrations of the new plenum

   With the mould and plenum itself as prop, I introduced the basics of creating a carbon fibre laminate to the students, giving them an idea of what they can get into and make as a student in university.

Health and Safety

A few health and safety hazards relating to the handling of the fractured samples of CFRP, and the GFRP moulds. Nitrile gloves were handed out to the students for handling the fibre laminates.

The students were told to take care of splinters on the CFRP samples. The GFRP moulds were prepped to cover any sharp glass splinters however the students were still warned to not touch the moulds and just observe it.

Reflection on the Activity

The students were very excited about the concept of formula student and even more so on the opportunity to touch and examine raw carbon fibre in their hands. The students were thrilled that they are allowed to keep the testing CFRP laminates as souvenirs. I

would recommend to any recipients of this bursary in the future, to try and incorporate physical objects as a part of the demonstration, especially demos that are interactive with the students.