

## Investigating vibration and damping characteristics of short fiber bio-composites

### Background

Recent decade has seen considerable developments of bio-composite materials. Renewable resources, environmentally friendly production and disposal at the end of their life, being less expensive compared to glass and carbon fiber composites and having reasonable structural properties could be mentioned as the advantages of these materials. Short fiber reinforced bio-composites have interesting mechanical properties such as high strength/density and high stiffness/density ratios. Besides, the manufacturing process of these materials are quick and low cost. More importantly, bio-composites reinforced with natural fibers have interesting damping properties which makes them good candidates for a large number of applications including car industry and sports equipment such as tennis rackets and bikes.



Figure 1. Some areas of applications of bio-composites [www.naturalfibersforautomotive.com, www.pinterest.com, www.guapaco.com].

### Purpose and project description

The idea in this master project is to investigate the vibration behavior of short fiber bio-composites. The bio-composite which will be investigated will be fabricated from Poly-Lactic-Acid (PLA) as the matrix and short cellulose fibers (CF) as the reinforcement. PLA is one the highly applicable bio-polymers in different areas such as bio-medical applications. Also, cellulose fibers have attracted a lot of attention as the natural reinforcement for bio-composites. We will fabricate pure PLA samples and PLA-CF bio-composites with different volume fractions of fibers. Once the samples are ready, an experimental program will be conducted to investigate the vibration behavior and damping properties of both pure PLA and PLA-CF bio-composites. It is intended to investigate the effect of fibers on the dynamic properties of the material. Also, it will be naturally realized that what would be the required amount of fibers to have optimum damping properties.

According to the progress of the project and based on the student's interest, there will also be a possibility to pursue modelling of the vibration and damping behavior of the bio-composite as well.

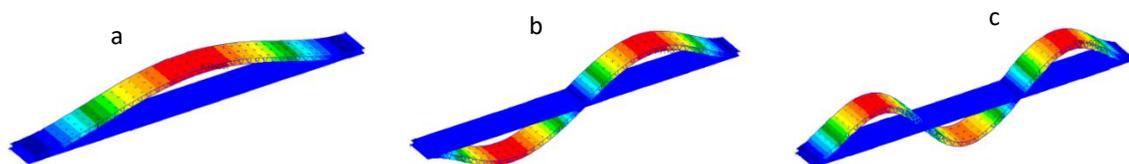


Figure 2. The first three modes of vibration of a beam: (a) The first order mode, (b) The second order mode, (c) The third order mode [Composite Structures 106 (2013) 85–95].

### Student background

This project is suitable for a student who is interested in experimental mechanics primarily. Interest in computational mechanics is required for the modelling part of the study.

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