Faculty of Engineering  
Summer Research Program 2019-2020

Project Title: Damage location and quantification on composite structures using characteristic acoustic emissions
Supervisor(s): W.K. Chiu
Department: Mechanical & Aerospace Engineering
Email: wing.kong.chiu@monash.edu
Website profile of project supervisor: https://research.monash.edu/en/persons/wing-chiu

Objective
The Space Shuttle Columbia accident was precipitated by a breach in the leading edge of the left wing caused by impact of a section of insulating foam during launch. All seven crew members were lost when the spacecraft disintegrated on re-entry. This disaster has served to focus worldwide attention on the requirement for effective structural health monitoring (SHM) techniques as a key enabler for future space exploration and new space technologies. In particular, acoustic emission (AE) sensors have been deployed and evaluated for impact detection on the Space Shuttle and the NASA X-33 prototype reusable launch vehicle (RLV).

Reusable Launch Vehicles (RLV) are essential for more cost effective, and hence more lucrative, access to space. The lesson from Columbia is that SHM will be required to supplement, or eventually replace, the current paradigm of periodic, ground based structural integrity inspections. However, current implementations of AE monitoring are qualitative, even in advanced demonstrator programs. This project aims to develop and demonstrate a quantitative AE technique for impact detection and characterisation in high-value aerospace composite structures.

Project Details
The student will be part of a team working towards the development of (a) A systematic experimental quantification of the AE modal signature for the failure mechanisms involved in impact damage of composite laminates, including the effects of damage size, through-thickness location and ply lay-up, (b) Quantitative characterization of AE through the use of modal coefficients (constituting the modal signature) for the various impact-damage failure mechanisms, identifying their dependence on geometric source parameters and loading conditions.

Prerequisites
MEC3453

Additional Information
NA