

Proposal for online Vibration Analysis, Failure Mechanisms & Life Prediction of AM systems course

Teachers: Dr Dario Di Maio

Total hrs: 24

Target: Postgraduate research students

Weeks: 8

Period: start 3rd Nov, end 22nd Dec. Every Wednesday 9am-12am

Lecture: 1hr per week

Number of students: 10-20

Assessment: Questionnaire

Coursework: Free-decay analysis, System identification, Application of VCCT for vibration fatigue

Lecture content (3 hr):

Week 1. Basics of Mechanical Vibrations part 1.

- a) Single DOF- linear systems
- b) Single DOF- nonlinear systems

Week 2. Basics of Mechanical Vibrations part 2.

- a) Multi-DOF- linear system

Week 3. Basics of System identification (SDOF)

- a) Peak-peaking
- b) Inverse method
- c) Dobson method
- d) Complex-FRF analysis

Week 5. Basics of Test equipment, Sensors and Signal Processing.

- a) Contact sensors
- b) Non-contact sensors
- c) Modal testing setup
- d) FFT analysis and windowing

Week 4. Basics of Damage Mechanism of Composite and 3D printed materials.

- a) Low and High Cycle Fatigue

Week 6. Basics of Vibration Fatigue.

- a) Resonance Phase-lock loop
- b) Response phase monitoring

Week 7. Finite Element modelling of fatigue damage growth.

- a) Modal analysis
- b) Steady-State Dynamics
- c) Virtual Crack Closure Technique

Week 8. Example of vibration fatigue test for Composite and 3D printed aluminium materials

- a) Challenges
- b) Data analysis

Reading list

References given in the slides