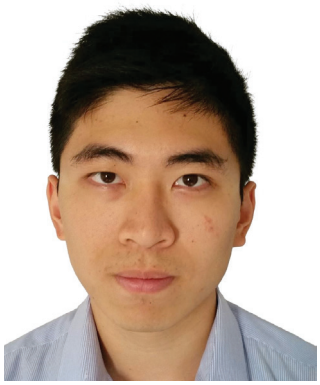

TRACK 1: STRUCTURES AND ADDITIVE MANUFACTURING

"SPACEFRAME STRUCTURAL OPTIMISATION WITH GENETIC ALGORITHM"

BY
ME4 JARAD LIM JIAN AN
REPUBLIC OF SINGAPORE AIR FORCE

ABSTRACT

The reduction of structural weight provides significant benefits in many engineering applications. While methods to optimise structural shape and topology of both continuous solids and discrete truss and frame structures have existed for a while, the advent of additive layer manufacturing processes has enabled more complex geometries to be feasible.

We investigate the use of topology optimisation on frame structures composed of repeating bays in one axis. Homogenised (length-independent) behavior is sought for the objectives of minimum mass and maximum effective flexural rigidity, obtained through self-developed finite element (FE) code and formulation based on strain-energy. The structural topology is parametrized using a novel graph-theory formulation; a Genetic Algorithm (GA) is then used to optimise its topology, size and geometry to meet the required objectives. General principles of structural optimization with GA and other potential applications of the method are also discussed.

BIOGRAPHY OF SPEAKER

Jarad Lim is an Air Force Engineer by vocation in the Republic of Singapore Air Force. He holds a BEng in Aerospace Engineering from Nanyang Technological University and an MSc in Advanced Lightweight Structures and Impact from Cranfield University, where he has built expertise with composite materials, failure and impact modelling and crashworthiness engineering. He has a deep interest in optimization techniques and its application to novel areas beyond structural design, such as maintenance planning.