Minimizing stress concentration around the voids by location optimization

Dedao Liu[1, a], Louis N. S. Chiu[2, 3, b], Chris Davies[1, c] and Wenyi Yan[1, d*]

[1] Department of Mechanical and Aerospace Engineering
Monash University, Clayton VIC3800, Australia
[2] Department of Materials Science and Engineering
Monash University, Clayton VIC 3800, Australia
[3] Monash Centre for Additive Manufacturing (MCAM)
Monash University, Clayton, VIC 3800, Australia
[a]dedao.liu@monash.edu, [b]louis.ngai.chiu@monash.edu,
[c]chris.davies@monash.edu, [d*]wenyi.yan@monash.edu

Abstract

Structural optimization has experienced fast development during the past decades. It plays a vital role in component designs. Designs from structural optimization are usually too complex for traditional manufacturing to build. Additive manufacturing has provided the capability of building some complex designs and it is becoming a norm to apply structural optimization in the design for additive manufacturing. Many of the designs introduce internal voids to reduce the component weight. The location of these internal voids has a significant influence on the stress distribution in the component. Thus, a novel location optimization method is developed in this paper to minimize the stress concentration around the voids by redistributing the voids location. A heuristic searching method is used to get an optimized voids location. Case studies have achieved significant stress reduction using this location optimization method.

Keywords: Location optimization; Stress concentration; Additive Manufacturing; FEA