Erasmus Mundus Joint Master in Manufacturing 4.0 by intElligent and susTAinable technologies

MASTER's Degree Thesis

"Investigation of machining residual stress on fatigue life at the groove scale"

Candidate: *Maldeniya Arachchige Don Sachintha Banuka Maldeniyaarachchi*

Supervisors: *Prof. Fréderic Valiorgue (École nationale d'ingénieurs de Saint-Étienne), Prof. Daniele Ugues (Politecnico di Torino), Prof. Cédric Bosch (Ecole des Mines de Saint-Étienne).*

Abstract:

Machining is a subtractive manufacturing method that eliminates materials and forms grooves with consecutive passes of a machined tool on machined surface. This machined induced surface integrity has a significant impact on the fatigue life of sectors like as aerospace and nuclear components, among others. Residual stress influences fatigue life on a global scale. However, two-scale method to modelling 3D residual stresses, developed by MISUTECH indicates that a residual stress gradient exists on the machined surface. However, fatigue curves do not take these characteristics into consideration and instead assume that the surfaces are relaxed and completely smooth. And the effect of groove scale residual stress on fatigue life of machined components is a novel issue that has yet to be discovered. This innovative study

was conducted to assess global and local residual stresses on the fatigue life of machined components.

Keywords: Grooves, machining residual stress, fatigue life

September 2025