Build Geometry Monitoring and Control for Wire Arc Additive Manufacturing Process

Alexandra Schueller

Advisor: Dr. Christopher Saldaña

Georgia Institute of Technology

aschueller3@gatech.edu

Abstract:

Metal additive manufacturing's ability to create parts of virtually any shape from metal wire or powder could help opposing states bypass international export controls, produce restricted parts, and develop nuclear weapons without the knowledge of the nonproliferation community. Discreetly monitoring a part's shape during a build could help identify when bad actors are producing restricted parts. In addition, processes such as wire arc additive manufacturing (WAAM) suffer from a high level of build geometry variability, and often require many test builds to be conducted in order to tune the process parameters sufficiently for a new project.

This research focuses on using only in-process infrared images, which can be captured discreetly, along with machine learning other pattern recognition techniques, to identify the specific shapes and dimensions of WAAM beads being deposited, the process parameters currently being used, and any changes to those parameters which could improve the process' geometric stability. It also investigates correlations between build temperature features and details of the build's final geometry. These investigations have applications to both nuclear nonproliferation goals overseas, as well as to the improvement of manufacturing capability and efficiency here in the United States.