Centre for Mechanical Engineering, Materials and Processes

CEMMPRE

PROPOSTA DE PLANO DE DOUTORAMENTO/DOCTORAL PLAN PROPOSAL
(a ser redigido em Inglês / to be filled in English)

ORIENTADOR(A)/SUPERVISOR: Maria Teresa Freire Vieira

GRUPO/GROUP: Materials and Processes

ORIENTADOR(A)/SUPERVISOR: Joaquim Norberto Cardoso Pires da Silva

GRUPO/GROUP: Mechanical and Intelligent Manufacturing

LOCAL DE REALIZAÇÃO DO TRABALHO/PLACE OF WORK: Department of Mechanical Engineering, University of Coimbra, Portugal

TÍTULO DO PLANO DE DOUTORAMENTO/TITLE OF THE DOCTORAL PLAN: Intelligent additive manufacturing of metal powder

RESUMO/SUMMARY (max. 300 words total)

Objetivo/Objectives:

Improvement of components in a sector with a significant impact in the carbon footprint, such as the aeronautical and automotive industry is imperative. New additively manufactured (AM) components will contribute positively to an effective energy utilisation and reduced environmental impact (reduced emissions). The development of a joint venture between AM and robotics is highly significant but it requires a deep knowledge of the material behaviour throughout the process. This plan aims to establish a set of methodologies for successful integration of a new AM technology - Fused Filament Fabrication (FFF) - to a robot, harvesting the advantages of both processes. Robotics in FFF technology can offer a wide set of tools that are not available on commercial systems, like real-time process monitoring, movement...
precision and speed adjustment, extrusion angles, etc. that can be dynamically contribute to the needs of the final part, making AM a more reliable process. Therefore, the material must be studied across the whole process, as an essential input for any modifications made in AM. This study is also fundamental for increasing the number of parts/systems/devices series. Moreover, this PhD could be a master study for other applications.

**Resultados Esperados/Expected Results:**

The candidate must be able to use and parametrize a robotic apparatus with an integrated new AM process – FFF - using metallic materials and geometries to be used for emission reduction in automotive and aeronautical industries. The integration with the robotic apparatus must include different methodologies for a successful final part:

- Collection of design rules for FFF.
- Filament fabrication methodology.
- Automatic shrinkage compensation, dependant on the material and geometry.
- Establish a set of processing parameters for optimal densification (Extrusion behaviour, Strategy, Layer Thickness, etc.).
- Characterization and critical analysis of final part properties and characteristics.
- Development of a case study in an industrial field.

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