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Additive manufacturing for metals — General principles — Registration of data acquired from process monitoring and for quality control

Fabrication additive de métaux — Principes généraux — Enregistrement de données acquises à partir de la surveillance du procédé et pour le contrôle qualité

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Foreword

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Introduction

Additive manufacturing (AM) is the general term for those technologies that successively join material to create physical objects as specified by their 3D design model data. Current AM technologies can fabricate parts layer-by-layer using different material types as inputs. The resulting parts have complex geometries that are needed for applications in a variety of manufacturing industries, where AM parts offer significant advantages or where the parts cannot be made using the traditional manufacturing technologies, such as machining and welding.

AM machines are being instrumented with various types of sensors which collect data throughout a build. Often, each sensor is designed to collect only one type of measurement dataset in a unique coordinate system. The use of this monitoring data for applications such as qualifying AM components is enhanced when a diverse range of sensor datasets are used and compared to post-process inspection. This requires multi-modal dataset registration including data alignment.

Registration of these datasets consists of recording necessary metadata and data alignment. A registered dataset allows the extraction of features from data from different sensors to be appropriately registered to post-process inspection. These features can be used for a range of applications including to control variations in feedstock, melt-pool geometry, thermal stability, layer integrity, defect detection, and part quality.

It is the intention of this document to provide a procedure and methods to register AM data, including:

a) associating validated data with known time, locations, and origin, and

b) data alignment for process monitoring and control.

Laser-based powder bed fusion for metals (PBF-LB/M) is used to demonstrate the data registration procedure. The procedure can be applied to monitor other AM processes, such as direct energy deposition, polymer or ceramic powder bed fusion, binder jetting, and photopolymerization.