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Editorial

Editorial for Additive Manufacturing

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Since its emergence in the 1980s, additive manufacturing has rapidly evolved into many forms. With capabilities that are impossible with conventional manufacturing processes, additive manufacturing has been recognized as a new paradigm for the manufacturing industry and its applications have expanded in numerous areas, including the medical, aerospace, automotive, construction, defense, and consumable sectors. However, despite the great potential of this technology, the widespread adoption of additive manufacturing in mainstream manufacturing has encountered barriers and challenges, which include manufacturing repeatability and reliability, affordability, and a lack of standards.

Big data analytics technologies can play a critical role in tackling some of these challenges. By implementing additive manufacturing digitally and building a digital thread for it, additive manufacturing data can be managed and utilized across its lifecycle in order to promote process repeatability and part-to-part reproducibility, shorten development cycles, and enhance supply chain and production processes. Additive manufacturing and big data analytics are recognized as two of the 11 key contributing technologies in Industry 4.0. The application of big data analytics to additive manufacturing is a highly interdisciplinary technology that has recently been the focus of increasing attention. This special issue includes three articles within this field:

"Applying neural-network-based machine learning to additive manufacturing: Current applications, challenges, and future perspectives" provides an overview of current progress in the application of the neural network algorithm to various aspects of additive manufacturing, including model design, *in situ* monitoring, and process–property–performance linkage. "Data-driven microstructure and microhardness design in additive manufacturing using a self-organizing map" presents an approach that combines physics-based models, experimental measurements, and a data mining method to develop data-driven process–structure–property linkages, which can be used for microstructure and microhardness design in additive manufacturing. Finally, in "Data mining for mesoscopic simulation of electron beam selective melting," a simulation-driven optimization framework consisting of mesoscopic modeling and data mining is proposed in order to quantitatively link various processing parameters to the morphological features of the melt track in the electron beam selective melting process.

These articles provide a glimpse into how big data analytics technologies can be applied to additive manufacturing in order to help identify possible areas of concern with final parts production, which could result in more robust build processes and effective cost-saving measures. We encourage more researchers to explore the advantages of big data analytics technologies, and to carry out innovative research in the field of additive manufacturing.

While additive manufacturing welcomes cross-disciplinary exploration, the technology itself still has plenty of room to grow. Two more articles on the topic of additive manufacture are included in this special issue:

Additive manufacturing can be used to fabricate components with complex geometry from a variety of materials. Meanwhile, a growing demand for the fabrication of complex microstructures from a wide range of materials such as ceramics, metals, polymers, and semiconductor materials has been observed in the field of micro-electromechanical systems (MEMS) technology. "Development of micro selective laser melting: The state of the art and future perspectives" reviews the state of the art of selective laser melting of metallic materials at the microscale. "Influence of particle size on laser absorption and scanning track formation mechanisms of pure tungsten powder during selective laser melting" presents a detailed study of the selective laser melting process on pure tungsten powder, combining numerical and experimental methods.

With the publication of this special issue, we hope to further the discussion on recent progress in additive manufacturing in various research dimensions. We would also like to take this opportunity to thank all the authors for their contributions to this special issue.

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