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EDITORIAL

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Special issue: Near-net shaping technology

Near-net shaping is an efficient, economical and environmentally-friendly approach to manufacture products which are very close to the final shape, reducing the need for surface finishing. It has become more and more important to use raw materials and energy in an optimal way. Near-net shaping technology has attracted increasing attention in both academic and industrial communities, especially in China, because China has become the world's largest regional market for main material forming methods, such as casting, forging and injection molding.

The main objective of this special issue in *Frontiers of Mechanical Engineering* is to bring together the leading ideas, experience and research results of academic scientists and researchers on various aspects of near-net shaping technology. This special issue contains eleven papers contributed by prestigious experts from different countries, including four reviews and seven research articles. These papers cover a broad area of the near-net shaping technology, and focus on the recent advances on a wide variety of fabrication methods, such as near-net casting, precision forging technology, and plastic injection molding. These papers also propose some novel fabrication methods, such as lost foam casting under vacuum, low pressure and vibration solidification, targeted cooling and heating technique for the single crystal blades, and a three-stage microcellular injection process. Besides, the latest developments of numerical simulation and intelligent technology in process optimization are also included to provide the readers with a broad view. The numerical simulation results on the micro hydromechanical deep drawing, premature melt solidification and plastic injection-compression molding also show a good agreement with experimental results.

Four review papers cover related near-net shaping methods applied in industrial areas for different materials, including metal, polymer and biomaterials. Zhenghuan Hu et al. reviewed the feature of shaft part rolling and working principles of two types of shaft part rolling, i.e., cross wedge rolling and skew rolling, and presented the latest progresses. Xinyun Wang et al. presented a detailed review of the development and trends of aluminum alloy precision forging technology. Several new technologies are introduced, such as closed die forging, isothermal die forging, local-loading forging and flow control forging. Peng Zhao et al. summarized and reviewed widely used scaffold fabrication methods, including conventional methods, electrospinning, 3D printing and combination of molding techniques. They also give some guidance and suggestions for the future of scaffold fabrication. Besides, in

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the review of Dequn Li et al., the recent researches and developments of the intelligent methods applied in process parameter determination of injection molding were presented. The current intelligent methods and existing results were provided, including case based reasoning methods, expert system based methods, and data fitting and optimization methods.

Three papers are focused on novel fabrication methods in the near-net shaping. In detail, Wenming Jiang and Zitian Fan proposed a novel lost foam casting technology under vacuum, pressure and vibration solidification, which has a positive effect for solving the current technological issues and promotes the technological progress for the lost foam casting. Dexin Ma reviewed the current casting techniques for single crystal blades of superalloys, as well as presented a series of novel casting techniques, such as the grain continuator and the heat conductor technique, the parallel heating and cooling system, dipping and heaving technique, and the targeted cooling and heating technique. Thomas Ellingham et al. proposed a novel three-stage molding process of manufacturing low-density, foamed thermoplastic polyurethane parts with variable properties using the microcellular injection molding process, which can be used to manufacture tunable densities and mechanical behavior with custom shapes.

Four papers conduct the numerical simulations to investigate the mechanism of fabrication methods. Liang Luo et al. developed a Voronoi finite element model to consider the open and closed lubricant pockets separately, and the micro hydromechanical deep drawing simulations were conducted, which agreed well with the experimental results. Menghuai Wu et al. analyzed the influence of pouring process on the premature solidification by using a numerical model, that is, a five-phase mixed columnar-equiaxed solidification. An improved simulation-experiment agreement was achieved by considering the effect of premature melt solidification during mold filling. Yun Zhang et al. developed a 3D simulation method for the injection-compression molding, in which the Arbitrary Lagrangian-Eulerian was used to trace the melt motion and update the flow field in compression stage. Considering the non-Newtonian characteristics and compressibility of the polymer, the proposed model can achieve a more accurate prediction of flow front and cavity pressure. To determine casting defect in near-net shape casting aluminum parts, Jiehua Li et al. used the computed tomography, which has proved to be an efficient method. They also found that the low pressure die casting can significantly reduce the formation of casting defects (i.e., porosity) due to its smooth filling and solidification in comparison with die casting.

Finally, we thank all reviewers for their useful and timely comments on the papers submitted to this special issue. Thanks to all the authors for submitting such valuable work. We also express appreciation to the journal's administrative support team that made the issue possible. We hope that you enjoy the special issue.

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