

Validation and Visualization of Objects used for the production of Direct Digital Manufacturing components or 3D Printed models

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Abstract

Direct Digital Manufacturing (DDM) and 3D Printing (3DP) processes begin with the creation of computer generated models of the parts to be produced. Once shapes are developed they are exported into a format suitable for reproduction, most commonly to a polygonal or tessellated pattern. Prior to processing parts by means of a “prototyping technique,” it is pertinent to verify if the geometry is suitable for reproduction, or if patterns and shapes are consistent. In order to visualize and corroborate shape-defining patterns for reproduction, validating procedures can be employed to assess forming requirements.

Generally, topology optimization methods are used to assess design features of elements to be produced. Traditional manufacturing processes, such as machining or casting -where the part is produced by material removal or by formative processes- have significant constraints that must be taken into account during the design stages to ensure manufacturing feasibility. These constraints limit optimal topology and a compromise has to be made between optimality and ease of manufacture.

Topology optimization is a powerful approach for determining the best distribution of material for a design. Often, the optimized topology is complex and due to manufacturing constraints commonly requires either simplification following the optimization process or constraining of the design to permit manufacturability.

DDM and/or 3DP enable the manufacture of the topology irrespective of the complexity, and the cost of production does not usually increase with complexity. In fact, sometimes the cost can decrease with increased complexity. While currently considered a niche area of manufacturing, DDM and/or 3DP offer great potential for physically realizing designs of greater optimality than possible with traditional manufacturing approaches.

Biography

RAFAEL OBREGÓN is currently an Associate Professor for the Engineering Technology Department at Western Illinois University. He is an internationally recognized expert in Design and Manufacturing and has over 22 years of experience as an engineer, manager, and educator. He is a Certified Manufacturing Technologist by SME and member of the Latin American and Caribbean Consortium of Engineering Institutions. Mr. Obregón may be reached at mfro@wiu.edu.