

## **A Construct to Perform in Situ Deformation Measurement of Material Extrusion-Fabricated Structures**

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**Abstract :** Material extrusion is an additive manufacturing modality that continues to show great promise in the ability to create low-cost, highly intricate, and exceedingly useful structural elements. As more capable and versatile filament materials are devised, and the resolution of manufacturing systems continues to increase, the need to understand and predict manufacturing-induced warping will gain ever greater importance. The following study presents an in situ remote sensing and data analysis construct that allows for the in situ mapping and quantification of surface displacements induced by residual stresses on a specified test structure. This proof-of-concept experimental process shows that it is possible to provide designers and manufacturers with insight into the manufacturing parameters that lead to the manifestation of these deformations and a greater understanding of the behavior of these warping events over the course of the manufacturing process.

**Keywords :** additive manufacturing, deformation, digital image correlation, fused filament fabrication, residual stress, warping

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