

Material Modelling of FDM printed PLA part

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Abstract.

This paper focuses on modelling inelasticity of additively manufactured polylactide (PLA) thermoplastic using Fused Deposition Modelling (FDM) printing technology. The material response of PLA is viscoplastic and temperature-dependent, as is typically seen for thermoplastics. The inelastic deformation of printed PLA undergoes initial yielding, strain softening, and subsequent failure. The Three-Network (TN) constitutive model was employed in this work, which captures experimentally observed material response and consists of three molecular equilibrium and time-dependent viscous networks that act in parallel. The parameter identification was performed in accordance with experimental data from uniaxial testing and a validation experiment was carried out by loading plate with a hole and measuring its strain distribution using Digital Image Correlation (DIC) method, which was compared with the predictions from Finite Element Analysis (FEA).