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**Title: Identification of Design Principles for Additive Manufacturing
from Online Part Repositories**

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Abstract:

While additive manufacturing has matured over recent decades, existing design principles for additive manufacturing are considered non-comprehensive. We discuss a novel method for extracting such design principles. These principles aid designers in creating high-quality, functional, and reliable components. We use an online open crowd-source repository for additively manufacturable components, Thingiverse.com, as the source for extracting design principles. Uniquely, Thingiverse provides a genealogical history of modifications to components. We hypothesize that these modifications are made to improve upon the original design. Potential design principles are identified from an analysis of changes of 339 artifacts in 67 unique lineages. An affinity analysis of all of the potential principles identified is performed revealing 23 unique design principles. These principles are found to range in specificity. These levels of specificity from general to specific include (i) design for manufacturing, (ii) design for digital manufacturing, (iii) design for additive manufacturing, and (iv) design for fused filament fabrication. These principles include using cellular structures to reduce weight and material used, print functional joints instead of assembling, orient critical profiles in the plane of highest resolution, among others. Such principles were uncovered from the study of the evolution of several designs in the crowd-sourced repository.