New method of manipulating digital models enables a user to reduce or eliminate the amount of support material needed to fabricate complex parts or assemblies.

Researchers at the University of Central Florida have developed a method that optimizes and reduces the costs associated with additive manufacturing. By using techniques to deform configurations of original objects, the new method reduces or eliminates the amount of support material needed to fabricate complex parts or assemblies. Additive manufacturing relies on support material to fabricate components, such as those that feature overhangs, enclosed volumes, or similar structures that would otherwise fail during production. The amount of support material used and the time needed to remove it from a finished part can directly increase overall costs and extend production build period. Even support material that dissolves in solution can affect expenses by way of solvent prices, time of dissolution, and drying time.

Technical Details

The invention uses physical simulation techniques, such as finite element analysis (FEA) and smoothed particle hydrodynamics (SPH) to generate viable deformed configurations of original objects. Deformations may be strain- or force-induced, for example, by compressing, collapsing, stretching, twisting, bending and torquing. The deformed digital configurations are then used to produce the components via additive manufacturing, which results in reduced fabrication material, time and cost. A “viable deformed configuration” refers to a recoverable deformed configuration or the state of the original model. The new method works best with configurations that use flexible materials. Figure 1 and Figure 2 show an example flowchart of the method and how it can be applied.

Figure 1. Flowchart of the invention process.

Figure 2. A 3D digital model in its original or undeformed configuration represents the input to the method. The model is discretized and then deformed using standard meshing tools and physical simulation methods such as Finite Element Analysis (FEA) or Smooth Particle Hydrodynamics (SPH).

Benefits

• Reduces build time, support material usage and print cost
• (Does not change the underlying design or topology of a part or assembly (such as the use of linkages or hinges)
• Works best with flexible materials

Applications

• Multi-material printers

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Printers capable of printing flexible materials
Orthotics and prosthetic designs
Wearable designs
Objects with internal voids or cavities such as lumens, vessels, containers or hollow structures