

# 1. Introduction

Rapid prototyping is still the most common name given to a host of related technologies that are used to fabricate physical objects directly from CAD data sources. These methods are unique in that they add and bond materials in layers to form objects or parts. Such additive fabrication technologies are also increasingly becoming known as 3D printing, but the general terms solid freeform fabrication and layered manufacturing are also frequently used.

They offer advantages in many applications compared to classical subtractive fabrication methods such as milling or turning:

- objects can be formed with any geometric complexity or intricacy without the need for elaborate machine setup or final assembly;
- objects can be made from multiple materials, or as composites, or materials can even be varied in a controlled fashion at any location in an object;
- the fabrication of complex objects is reduced to a manageable, straightforward, and relatively fast process.

These properties have resulted in their wide use as a way to reduce time to market in manufacturing. Today's systems are heavily used by engineers to better understand and communicate their product designs as well as to make rapid tooling to manufacture those products. Surgeons, architects, artists and individuals from many other disciplines also routinely use the technology.

The names of specific processes themselves are also often used as synonyms for the entire field of rapid prototyping. Among these are stereolithography (SLA for stereolithography apparatus), selective laser sintering (SLS), fused deposition modeling (FDM), laminated object manufacturing (LOM), inkjet-based systems and three dimensional printing (3DP). Each of these technologies - and the many other rapid prototyping processes - has its singular strengths and weaknesses.

The proliferation of terminology in the field has led to quite a bit of confusion. In this book, the overall field is for the most part referred to as "additive fabrication" and the terms "rapid prototyping" and "3D printing" are used somewhat interchangeably depending on context. See the Appendix article "What's all this name stuff anyway?" for a thorough discussion of the field's terminology.

In the distant future, there is no doubt that computers will be used to automatically manufacture objects, products and systems of every description and kind with no limit to complexity. The inputs to these fabrication systems will simply be raw materials and data. This technology will be reminiscent of desktop publishing - but instead of documents and printed matter, the diverse products that we need or desire to use in our lives will be manufactured for us on the spot. We'll also be able to efficiently make complex things in small volumes without tooling, and with material properties that we can only dream about now. This scenario is still a way off, but the very real foundation for that world exists today.

**The rest of the Chapter is Omitted  
in this brief sample.**