From Virtual to Real

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Abstract
A wide-spread adoption of 3D printing is democratizing manufacturing. The ever expanding range of printing materials allows for fabrication of complex multi-material objects that cannot be manufactured using any other method. However, while there has been tremendous progress in the development of the output devices, the provided digital content creation software, algorithms, and tools are largely underdeveloped. The overall situation is analogous to the digital printing and content creation revolution of the early 1980s before the advent of PostScript.

In this talk, I will describe abstractions that are necessary to scale the complexity of the 3D printed models. First, I will present OpenFab - a direct specification pipeline for multi-material fabrication - inspired by the programmable pipelines used for film and real-time rendering. The pipeline introduces user-programmable fablets - procedures evaluated for each point inside of the object volume that return material composition. The system is designed to stream over arbitrary numbers of voxels with a fixed and controllable memory footprint. As an alternative to directly specifying material composition, it is often more natural to specify an object by defining its functional goal (e.g., specific color, stiffness, or refractive index). To address this problem, we have developed Spec2Fab - a computationally efficient and general process for translating functional requirements to fabricable 3D prints. Finally, I will demonstrate a variety of applications that take advantage of both systems.

Biography
Wojciech Matusik is an Associate Professor of Electrical Engineering and Computer Science at the Computer Science and Artificial Intelligence Laboratory at MIT, where he leads the Computational Fabrication Group. Before coming to MIT, he worked at Mitsubishi Electric Research Laboratories, Adobe Systems, and Disney Research Zurich. He studied computer graphics at MIT and received his PhD in 2003. He also received a BS in EECS from the University of California at Berkeley in 1997 and MS in EECS from MIT in 2001. His research interests are in direct digital manufacturing and computer graphics, particularly in modeling and physical reproduction of materials, computational photography, and novel display systems.