KEYNOTE TALK
Monday, July 29, 2013
8:30 AM – 9:30 AM / MEGAS ALEXANDROS

ISVC 2013: 9th International Symposium on Visual Computing
Crete, Greece, July 29-31, 2013

How to break things with least effort

Denis Zorin
Courant Institute
New York University, USA

Abstract

3D printing and other types of direct digital manufacturing are rapidly expanding industries that provide easy ways to manufacture highly customized an unique products. The development pipeline for such products is radically different from the conventional manufacturing pipeline: 3D geometric models are designed by users often with little or no manufacturing experience, and sent directly to the printer. Structural analysis on the user side with conventional tools is often unfeasible as it requires specialized training and software. Trial-and-error, the most common approach, is time-consuming and expensive. The goal of the work that I will present is to develop a method that would identify structural problems in objects designed for 3D printing based on geometry and material properties only, without specific assumptions on loads and manual load setup, and present them to the user in an intuitive way. We formulate the problem as a constrained optimization problem to determine the ``worst'' load distribution for a shape that will cause high local stress or large deformations. While in its general form this optimization has a very high computational cost even for relatively small models, we demonstrate an efficient heuristic based on modal analysis and an approximation by a linear programming problem that can solve the problem quickly for the typical size of printed models. We validate our method both computationally and experimentally and demonstrate that it has good predictive power for a number of diverse 3D printed shapes.

Speaker Bio-Sketch: Denis is a professor of computer science and mathematics at the Courant Institute of Mathematical Sciences at New York University (NYU). He received his PhD from California Institute of Technology in 1997, and was a postdoctoral researcher at Stanford in 1997-98. Denis's research interests span the domains of geometric modeling, geometry processing and scientific computing. His main contributions are in the theory and practical algorithms for subdivision surfaces, surface deformation and mapping and efficient computational methods for integral equations. He has received the NSF Career Award, Sloan Foundation Fellowship, several IBM Partnership awards and shared the ACM Gordon Bell Prize in 2010. His work has won a number of best paper awards. Denis is an associate editor of ACM Transactions on Graphics. Denis Zorin is also a Founding Faculty Fellow of the Skolkovo Institute of Science and Technology (Skoltech), a new university in Moscow, Russia, developed in cooperation with MIT.