Modeling and Toolpath Generation for Consumer-Level 3D Printing

References on 3D printing

SIGGRAPH 2015 Course

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This is not an exhaustive list and is only intended to help the interested reader start exploring the vast amount of work done in each of these areas. If some important references are missing please let us know and we'll do our best to update this document.

1 Part orientation

- W. Cheng, J.Y.H. Fuh, A.Y.C. Nee, Y.S. Wong, H.T. Loh, and T. Miyazawa. Multi-objective optimization of part- building orientation in stereolithography. *Rapid Prototyping Journal*, 1, 1995

- S Danjou and P Köhler. Determination of optimal build direction for different rapid prototyping applications. In *Proceedings of the 14th European Forum on Rapid Prototyping*, 2009

- K Thrimurthulu, Pulak M Pandey, and N Venkata Reddy. Optimum part deposition orientation in fused deposition modeling. *International Journal of Machine Tools and Manufacture*, 44(6):585–594, 2004

- Kailun Hu, Shuo Jin, and Charlie CL Wang. Support slimming for single material based additive manufacturing. *Computer-Aided Design*, 65:1–10, 2015

- Dietmar Frank and Georges Fadel. Expert system-based selection of the preferred direction of build for rapid prototyping processes. *Journal of Intelligent Manufacturing*, 6(5):339–345, 1995

- David C Thompson Richard H Crawford. Optimizing part quality with orientation. In *Solid Freeform Fabrication Symposium Proceedings*, page 362. Center for Materials Science and Engineering, Mechanical Engineering Department and Chemical Engineering Department, the University of Texas at Austin, 1995

- Paul Alexander, Seth Allen, and Debasish Dutta. Part orientation and build cost determination in layered manufacturing. *Computer-Aided Design*, 30(5):343–356, 1998

- SH Masood, W Rattanawong, and P Iovenitti. Part build orientations based on volumetric error in fused deposition modelling. *The International Journal of Advanced Manufacturing Technology*, 16(3):162–168, 2000

2 Printing large parts

- J. Vanek, J. A. Garcia Galicia, B. Benes, R. MÄŽch, N. Carr, O. Stava, and G. S. Miller. Packmerger: A 3d print volume optimizer. *Computer Graphics Forum*, 33(6):322–332, 2014

- Linjie Luo, Ilya Baran, Szymon Rusinkiewicz, and Wojciech Matusik. Chopper: Partitioning models into 3D-printable parts. *ACM Transactions on Graphics*, 31(6):129:1–129:9, 2012

- Ruizhen Hu, Honghua Li, Hao Zhang, and Daniel Cohen-Or. Approximate pyramidal shape decomposition. *ACM Transactions on Graphics (TOG)*, 33(6):213, 2014

- J Vanek, JA Galicia, B Benes, R Měch, N Carr, O Stava, and GS Miller. Packmerger: A 3d print volume optimizer. In *Computer Graphics Forum*, volume 33, pages 322–332. Wiley Online Library, 2014

3 Rigidity and robustness

- Ondrej Stava, Juraj Vanek, Bedrich Benes, Nathan A. Carr, and RadomÃŋr Mech. Stress relief: improving structural strength of 3d printable objects. *ACM Transactions on Graphics*, 31(4):48:1–48:11, 2012

- Lin Lu, Andrei Sharf, Haisen Zhao, Yuan Wei, Qingnan Fan, Xuelin Chen, Yann Savoye, Changhe Tu, Daniel Cohen-Or, and Baoquan Chen. Build-to-last: Strength to weight 3d printed objects. *ACM Transactions on Graphics*, 33(4):97:1–97:10, July 2014

- Weiming Wang, Tuanfeng Y. Wang, Zhouwang Yang, Ligang Liu, Xin Tong, Weihua Tong, Jiansong Deng, Falai Chen, and Xiuping Liu. Cost-effective printing of 3d objects with skin-frame structures. *ACM Transactions on Graphics*, 32(5), 2013

- Qingnan Zhou, Julian Panetta, and Denis Zorin. Worst-case structural analysis. *ACM Transactions on Graphics*, 32(4), 2013

4 Support structures

- Jérémie Dumas, Jean Hergel, and Sylvain Lefebvre. Bridging the gap: Automated steady scaffoldings for 3D printing. *ACM Transactions on Graphics*, 33(4):98:1–98:10, 2014

- Ryan Schmidt and Nobuyuki Umetani. Branching support structures for 3d printing. In *ACM SIGGRAPH 2014 Studio*, SIGGRAPH '14, pages 9:1–9:1, New York, NY, USA, 2014. ACM

- J. Vanek, J. A. G. Galicia, and B. Benes. Clever support: Efficient support structure generation for digital fabrication. *Computer Graphics Forum*, 33(5):117–125, 2014

- Seth Allen and Deba Dutta. Determination and evaluation of support structures in layered manufacturing. *Journal of Design and Manufacturing*, 5:153–162, 1995

5 Solid modeling for fabrication

- Tim Van Hook. Real-time shaded nc milling display. In *Proceedings of SIGGRAPH*, 1986

- Charlie C. L. Wang, Yuen-Shan Leung, and Yong Chen. Solid modeling of polyhedral objects by layered depth-normal images on the gpu. *Computer-Aided Design*, 42(6), 2010

- Zhiwen Zhao and Zhiwen Luc. Adaptive direct slicing of the solid model for rapid prototyping. *International Journal of Production Research*, 38(1):69–83, 2000

- Cyril Crassin. Fast and accurate single-pass A-buffer using OpenGL 4.0+, 2010. `http://blog.icare3d.org/2010/06/fast-and-accurate-single-pass-buffer.html`

- Cyril Crassin. OpenGL 4.0+ A-buffer v2.0: Linked lists of fragment pages, 2010. `http://blog.icare3d.org/2010/07/opengl-40-abuffer-v20-linked-lists-of.html`

- Jonas Martinez, Samuel Hornus, Frḃdḃric Claux, and Sylvain Lefebvre. Chained segment offsetting for ray-based solid representations. *Computer and Graphics*, 46(0):36 – 47, 2015

- Sylvain Lefebvre, Samuel Hornus, and Anass Lasram. Per–pixel lists for single pass A-buffer. *GPU Pro 5*, 2014. (to appear)

6 Slicing

- Pulak Mohan Pandey, N. Venkata Reddy, and Sanjay G. Dhande. Slicing procedures in layered manufacturing: a review. *Rapid Prototyping Journal*, 9(5):274–288, 1995

- Kristian Hildebrand, Bernd Bickel, and Marc Alexa. Orthogonal slicing for additive manufacturing. *Computers & Graphics*, 37(6):669–675, 2013

- Debasish Dutta, Fritz B Prinz, David Rosen, and Lee Weiss. Layered manufacturing: current status and future trends. *Journal of Computing and Information Science in Engineering*, 1(1):60–71, 2001

- Charlie C. L. Wang Pu Huang and Yong Chen. Intersection-free and topologically faithful slicing of implicit solid. *Journal of Computing and Information Science in Engineering*, 13, 2013

- Long Zeng, Lip Man-Lip Lai, Di Qi, Yuen-Hoo Lai, and Matthew Ming-Fai Yuen. Efficient slicing procedure based on adaptive layer depth normal image. 43(12):1577–1586, December 2011

- B. Starly, A. Lau, W. Sun, W. Lau, and T. Bradbury. Direct slicing of {STEP} based {NURBS} models for layered manufacturing. *Computer-Aided Design*, 37(4):387 – 397, 2005

- Kamesh Tata, Georges Fadel, Amit Bagchi, and Nadim Aziz. Efficient slicing for layered manufacturing. *Rapid Prototyping Journal*, 4(4):151–167, 1998

7 Toolpath optimization

- Yu-an Jin, Yong He, Jian-zhong Fu, Wen-feng Gan, and Zhi-wei Lin. Optimization of tool-path generation for material extrusion-based additive manufacturing technology. *Additive Manufacturing*, 1:32–47, 2014

- Vassilios Canellidis, Vassilis Dedoussis, N Mantzouratos, and S Sofianopoulou. Pre-processing methodology for optimizing stereolithography apparatus build performance. *Computers in industry*, 57(5):424–436, 2006

- S.H. Choi and H.H. Cheung. A topological hierarchy-based approach to toolpath planning for multi-material layered manufacturing. *Computer-Aided Design*, 38(2), 2006

- Pang King Wah, Katta G Murty, Ajay Joneja, and Leung Chi Chiu. Tool path optimization in layered manufacturing. *Iie Transactions*, 34(4), 2002

- Kenneth Castelino and Paul K. Wright. Tool-path optimization for minimizing airtime during machining. *Journal of Computing and Information Science in Engineering*, 2004

- SH Choi and WK Zhu. A dynamic priority-based approach to concurrent toolpath planning for multi-material layered manufacturing. *Computer-Aided Design*, 42(12), 2010

- H Xiaomao, Y Chunsheng, and H Yongjun. Tool path planning based on end-point build-in optimization in rapid prototyping. *Proceedings of the Institution of Mechanical Engineers (Part C)*, 2011

8 Large meshes

- Martin Isenburg and Stefan Gumhold. Out-of-core compression for gigantic polygon meshes. In *ACM Transactions on Graphics (TOG)*, volume 22, pages 935–942. ACM, 2003

- Peter Lindstrom. Out-of-core construction and visualization of multiresolution surfaces. In *Proceedings of the 2003 symposium on Interactive 3D graphics*, pages 93–102. ACM, 2003

- Yong-Jin Liu, Matthew Ming-Fai Yuen, and Kai Tang. Manifold-guaranteed out-of-core simplification of large meshes with controlled topological type. *The Visual Computer*, 19(7-8):565–580, 2003

9 Multi-filament

- Jean Hergel and Sylvain Lefebvre. Clean color: Improving multi-filament 3D prints. In *Computer Graphics Forum*, volume 33, pages 469–478, 2014. (to appear)

- Tim Reiner, Nathan Carr, Radomír Měch, Ondřej Šťava, Carsten Dachsbacher, and Gavin Miller. Dual-color mixing for fused deposition modeling printers. *Computer Graphics Forum*, 33(2):479–486, 2014