Nobuyuki Umetani

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Autodesk Research
Research Scientist, Head of Design and Fabrication Group
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PERSONAL SUMMARY

I finished my Ph.D. in September 2012 under the supervision of Prof. Takeo Igarashi. Currently, I am a research scientist at Autodesk Research, leading the Design and Fabrication group. Before that, I worked for Autodesk Research in Toronto (with Ryan Schmidt) and Disney Research Zürich (with Bernd Bickel) as a postdoctoral fellow for one year each. I am interested in computer graphics, interactive design interface and mechanical engineering, especially:

- Integrated Design, Simulation and Interaction
- Interactive Simulation
- Fabrication
- Finite Element Methods
- Data-driven Aerodynamics modeling and fabrication
- Biomechanical Simulation

When I was a master's student, I visited the applied mathematics department in TU Delft (the Netherlands) and worked with Prof. Scott MacLachlan and Prof. Kees Oosterlee. After I started my Ph.D, I visited Columbia University in New York and work with Danny Kaufman and Prof. Eitan Grinspun. In another research visit for my Ph.D., I collaborated with Prof. Niloy Mitra at the University College London. In addition, I won an internship at Microsoft Research Asia (working with Weiwei Xu and Xin Tong) in February 2012.

EDUCATION

Ph.D., Computer Science (October 2009 – September 2012)
The University of Tokyo, Japan
Thesis: Interactive Design Exploration of Physically Valid Shapes
Adviser: Takeo Igarashi

M.S., Frontier Science (April 2006 – September 2009)
The University of Tokyo, Japan
Thesis: Coupling analysis of skeletal muscles and skeletal system using Lagrange multiplier
Adviser: Toshiaki Hisada

B.S., Mechanical Engineering (April 2002 – March 2006)
The University of Tokyo, Japan
Thesis: Analysis of open and close phase of heart valve by changing connectivity in time step
Adviser: Toshiaki Hisada

PUBLICATION (JOURNAL)

Nobuyuki Umetani, Athina Panotopoulou, Ryan Schmidt, Emily Whiting , "Printone: Interactive Resonance Simulation for Free-form Print-wind Instrument Design", ACM Transaction on Graphics (SIGGARPH Asia 2016)

Nobuyuki Umetani, Ryan Schmidt , "SurfCuit: Surface Mounted Circuits on 3D Prints", IEEE Computer Graphics and

Applications

Tobias Martin*,Nobuyuki Umetani*,Bernd Bickel (*=joint 1st authors), "OmniAD: Data-driven Omni-directional Aerodynamics", ACM Transaction on Graphics (SIGGRAPH 2015), 34(4), July, 2014

Nobuyuki Umetani, Takeo Igarashi, Niloy J. Mitra, "Guided Exploration of Physically Valid Shapes for Furniture Design", CACM Research Highlights, Communications of the ACM (to appea

Nobuyuki Umetani, Yuki Koyama, Ryan Schmidt, Takeo Igarashi, "Pteromys: Interactive Design and Optimization of Free-formed Free-flight Model Airplanes" ACM Transaction on Graphics (SIGGRAPH 2014), 33(4), July, 2014

Weiwei Xu*, Nobuyuki Umetani*, Qianwen Chao, Jie Mao, Xiaogang Jin, Xin Tong (*=joint 1st authors), "Sensitivity-optimized Rigging for Example-based Real-time Clothing Synthesis", ACM Transaction on Graphics (SIGGRAPH 2014), 33(4), July, 2014

Shunsuke Saito, Nobuyuki Umetani, Shigeo Morishima, "Macroscopic and Microscopic Deformation Coupling in Up-sampled Cloth Simulation", Computer Animation and Virtual Worlds Journal, CASA 2014 Special Issue, 25(3-4), May-August, 2014

Susumu Katayama, Nobuyuki Umetani, Toshiaki Hisada, Seiryo Sugiura, "Bicuspid aortic valves undergo excessive strain during opening: A simulation study", The Journal of Thoracic and Cardiovascular Surgery, 2013

Nobuyuki Umetani, Takeo Igarashi, Niloy J. Mitra, "Guided Exploration of Physically Valid Shapes for Furniture Design", ACM Transaction on Graphics (SIGGRAPH 2012), 31(4), August, 2012.

Takashi Ijiri, Takashi Ashihara, Nobuyuki Umetani, Takeo Igarashi, Ryo Haraguchi, Hideo Yokota, and Kazuo Nakazawa, "A Kinematic Approach for Efficient and Robust Simulation of the Cardiac Beating Motion", PLos One.

Bo Zhu, Michiaki Iwata, Ryo Haraguchi, Takashi Ashihara, Nobuyuki Umetani, Takeo Igarashi, Kazuo Nakazawa. Sketch-based Dynamic Illustration of Fluid Systems. SIGGRAPH ASIA 2011

Nobuyuki Umetani, Danny Kaufman, Takeo Igarashi, Eitan Grinspun, "Sensitive Couture for Interactive Garment Editing and Modeling", ACM Transaction on Graphics (SIGGRAPH 2011), 30(4), August, 2011

Nobuyuki Umetani, Kenshi Takayama, Jun Mitani, Takeo Igarashi, "Responsive FEM for Aiding Interactive Geometric Modeling", Computer Graphics & Applications

Nobuyuki Umetani, Scott Maclachlan, Kees Oosterlee, "A Multigrid-Based Shifted-Laplacian Preconditioner for a Fourth-Order Helmholtz Discretization", Numerical Linear Algebra with Applications, Volume 16, Issue 8, pp603-626,(2008)

Susumu Katayama, Nobuyuki Umetani, Seiryo Sugiura, and Toshiaki Hisada, "The sinus of Valsalva relieves abnormal stress on aortic valve leaflets by facilitating smooth closure", The Journal of Thoracic and Cardiovascular Surgery, vol.136, no.6, pp.1528-1535,(2008)

PUBLICATION (CONFERENCE)

Nobuyuki Umetani, "Exploring Generative 3D Shapes Using Autoencoder Networks", Siggraph Asia 2017 Technical Brief

Rubaiat Habib, Tovi Grossman, Nobuyuki Umetani, George Fitzmaurice, "Motion Amplifiers: Sketching Dynamic Illustrations Using the Principles of 2D Animation", CHI 2016 Conference proceedings

Andrew O. Sageman-Furnas, Nobuyuki Umetani, Ryan Schmidt, "Meltables: Fabrication of Complex 3D Curves by Melting", SIGGRAPH Asia 2015 Technical Brief

James McCrae, Nobuyuki Umetani, Karan Singh, "FlatFitFab: Interactive Modeling with Planar Sections", In Proceedings of the ACM User Interface Software and Technology (UIST '14).

Nobuyuki Umetani, Ryan Schmidt, Jos Stam, "Position-based Elastic Rod", In Proceedings of the 21014 ACM SIGGRAPH/Eurographics Symposium on Computer Animation (SCA '14)

Nobuyuki Umetani, Ryan Schmidt, "Cross-sectional Structural Analysis for 3D Printing Optimization", SIGGRAPH Asia 2013 Technical Brief

Yupeng Zhang, Teng Han, Zhimin Ren, Nobuyuki Umetani, Xin Tong, Yang Liu, Takaaki Shiratori, Xiang Cao, "BodyAvatar: Creating freeform 3D avatars using first-person body gestures", In Proceedings of the ACM Symposium on User Interface Software and Technology (UIST '12).

Yuki Koyama, Kenshi Takayama, Nobuyuki Umetani, and Takeo Igarashi, "Real-time example-based elastic deformation", In Proceedings of the 2012 ACM SIGGRAPH/Eurographics Symposium on Computer Animation (SCA '12)

Nobuyuki Umetani, Kenshi Takayama, Jun Mitani, Takeo Igarashi, "Designing Custom-made Metallophone with Concurrent Eigenanalysis", In Proceedings of the 2010 New Interfaces for Musical Expression (NIME++2010)

Yohsuke Furuta, Nobuyuki Umetani, Jun Mitani, Takeo Igarashi and Yukio Fukui, "A Film Balloon Design System Integrated with Shell Element Simulation" (short paper), Eurographics 2010

PUBLICATION (BOOK)

"Introduction of Finite Element Methods in Computer Graphics", CG Gems JP 2013, chapter 11 (in Japanese).

"Clothing Simulation and Self-collision Handling using Finite Element Method", CG Gems JP 2012, chapter 9 (in Japanese).

PATENT

Techniques for modeling elastic rods in position-based dynamics frameworks, US 20160154906 A1

Techniques for optimizing orientation of models for three-dimensional printing, US 20150154321 A1

Methods, systems, and media for interactive garment modeling and editing, US 20140114620 A1

WORK EXPERIENCE

Research Scientist (March 2015-present)
Autodesk Research, Toronto, Canada

Postdoctoral Researcher (March 2014-February 2015)
Disney Research Zürich, Switzerland

Project Researcher (December 2013-Februrary 2014)
The University of Tokyo/JST ERATO, Japan

Fix-term Research Scientist (November 2012-November 2013)
Autodesk Research, Toronto, Canada

Internship Researcher (February 2012-May 2012)
Microsoft Research Asia, Beijing, China
Supervisor: Dr. Weiwei Xu

Research Fellow (April 2010-October 2012)
Japan Society for the Promotion of Science

Research Assistant (2008 - 2010)
JST ERATO Igarashi Design Interface Project, Japan
Supervisor: Dr. Takeo Igarashi

Chief Developer (2008)
Information – technology Promotion Agency (IPA) Exploratory Software Project, Japan
Supervisor: Dr. Ikuo Takeuchi

AWARDS

Microsoft Research Asia Fellowship (2011)

Best Paper Award (2010)
WISS 2010(Japanese UIST), 18th Workshop on Interactive Systems and Software

Yamanouchi Award (2009)
IPSJ(Japanese ACM), Japanese Symposium on Programming

SUPER CREATER (2008)
Information-technology Promotion Agency (IPA) Exploratory Software

TEACHING

University of Toronto, Geometry Processing (guest lecture on 3D Printing), Winter 2017

University of Toronto, Computer Graphics (guest lecture), Fall 2017

RESEARCH VISITS

Computer Science Department, University College London, UK (August2011-November-2011)
Mentor: Niloy J. Mitra

Columbia Computer Graphics Group, Computer Science Department, Columbia University, USA (April 2010-March 2011)
Mentor: Eitan Grinspun

Numerical Analysis Group, Delft Institute of Applied Mathematics, Delft University of Technology, The Netherlands (April 2007-March 2008)
Mentor: Kees Oosterlee

PROFESSIONAL SERVICE

Program Committee
Euro Graphics short paper: 2017,2018
CASA: 2017, 2018
Pacific Graphics: 2015,2016
Symposium on Computer Animation: 2016, 2017
CAD/Graphics: 2017
WSCG: 2017
ACM SIGGRAPH Technical Paper: 2015
ACM SIGGRAPH ASIA Brief and Poster: 2015

Associate Editor
The Visual Computer: 2016-2017

Reviewer
SIGGRAPH: 2012 - 2017
SIGGRAPH Asia: 2011 - 2017
TOG: 2015, 2016, 2017
Eurographics: 2012 - 2017
CGF: 2015,2016,2017
CHI: 2017
UIST: 2016, 2017
GrapdiFab: 2016, 2017
3DUI: 2014
IEICE: 2014
Pacific Graphics: 2014, 2015
TVCG: 2014, 2015, 2017
WSCG: 2017
CAD: 2016

INVITED TALK

"Simulation-guided Interactive Exploration of Functional Design", September 2016,
Host: Stelian Coros: VASC Seminar at Carngie Mellon University

"Simulation-guided Interactive Exploration of Functional Design", May 2016,
Host: Paul Kry

"Simulation-guided Interactive Exploration of Functional Design" October 2015
Host: Kun Xu, Pacific Graphics 2015 Invited Talk

"Simulation-Guided Creation: Interactive Simulation to Animate and Fabricate your Own Idea", June 2015,
Host: Marie-Paule Cani:"Expressive modeling : New advances towards the seamless creation of 3D content"

"Interactive Design of Functional Shapes", Schloss Dagstuhl, Germany, September 2014,
Host: Dagstuhl Seminar: "Computational Aspects of Fabrication"

"Interactive Authoring for Designing Physically Valid Shapes", University of Manitoba, May 2013,
Host: Jim Young

"Interactive Exploration of Physically Valid Shapes", Disney Research Zurich, February 2013,
Host: Bernd Bickel

"Integration of Design, Simulation and Interaction", Max Planck Institute Infomatik, October 2011,
Host: Michael Wand

"Interactive integration of design and real-time simulation", New York University, September 2010
Host: Kenshi Takayama

SOFTWARE

DelFEM: http://code.google.com/p/delfem/
This is an environment for solving various partial differential equations (PDE) using finite element method (FEM). Users can run FEA simulation through simple object oriented C++ problem description.

This library is very fast compare to other software using specially designed linear system solver. Thus it achieves real-time computation and interaction between shape modeling and numerical simulation. I developed this library from scratch.

Structural weakness detection for Autodesk MeshMixer®: http://www.meshmixer.com/
During my post-doc in Autodesk, I developed weak structure detection function for Autodesk MeshMixer. This function detects breakable location in a complicated 3D structure in a fraction of a second. This function is used for computational vilification of design for 3D printing. This technology was newly developed and described in a paper "Cross-sectional Structural Analysis for 3D printing".

Hair simulation for Autodesk Maya, Nucleus®: http://www.autodeskresearch.com/projects/nucleus
During my post-doc in Autodesk, I developed new version of hair simulation component for Nucleus. Nucleus is a simulation library for Maya, which is visual computing widely used design software in the computer animation industry.

Technical Skills

C++, C, OpenGL, Python, TensorFlow, Qt, C#, Fortran, .net, HTML, Subversion(SVN), PHP.

- Cross-platform C++ development, across Mac, Windows and Linux platforms.
- Developing large scale software (over 100 thousands lines)
- Distribute and maintain open-source software.