**Martin Bechthold** **CV**

Kumagai Professor of Architectural Technology
Harvard University, Graduate School of Design
48 Quincy Street
Cambridge, MA 02138

## Education

2001 Harvard University Graduate School of Design, Doctor of Design, Architecture
1991 Rheinisch-Westfälisch-Technische, Hochschule (RWTH) Aachen, Germany, Diplom-Ingenieur Architecture

## Academic Appointments and Leadership

| | |
|---|---|
| 2015 – present | **Co-Director, Master of Design Engineering**, Harvard GSD and SEAS |
| 2015 - present | **Kumagai Professor of Architectural Technology**, Harvard GSD |
| 2014 | **Visiting Professor**, TU Graz, Institute of Structural Design |
| 2014 - present | **Associate Faculty**, Wyss Institute for Biologically Inspired Engineering |
| 2013 – present | **Director,** Doctor of Design Program |
| 2008 – 2013 | **Co-Director**, Master in Design Studies Program |
| 2008 - 2015 | **Professor of Architectural Technology,** Harvard University Graduate School of Design |
| 2004 - 2008 | **Associate Professor of Architecture,** Harvard University Graduate School of Design |
| 2004-2005 | **Baumer Visiting Professor,** Ohio State University |
| 2001 - 2003 | **Assistant Professor of Architectural Technology,** Harvard University Graduate School of Design |
| 2000 - 2001 | **Instructor in Architecture,** Harvard University Graduate School of Design Fall |

## Funded Research

2015 – 2017 **Advanced Composites in Buildings**
Studies that develop new opportunities for the application of composite materials in buildings.
Sponsor: Advanced Multitech Group

2015 -present **Ceramic 3D Printing**
Develops digital clay deposition methods and related computational systems.
Sponsor: ASCER Tile of Spain.

2015 **Concrete 3D Printing**
Develops an assessment framework for evaluating the potential for concrete 3D printing in building construction.
Sponsor: Italcementi, Bergamo, Italy.

2011-ongoing **Adaptive Living Environments (ALivE)**
The research develops new material systems for buildings in collaboration with the Adaptive Materials Technology platform at Wyss (Prof. Joanna Aizenberg).
Sponsor: Wyss Institute of Biologically Inspired Engineering. Collaborating GSD faculty: Prof. Allen Sayegh.

2011- 2013 **Comprehensive Life Cycle Assessment Methods**
The research develops a framework for the assessment of sustainable products for high-performance building envelopes.
Sponsor: Miniwiz Taipei, Taiwan, now Harvard Center for Green Buildings and Cities.

2010 - present **Ceramic Futures**
This project studies innovative strategies for customization in the ceramics industry.
Sponsor: ASCER Tile of Spain.

2010 - ongoing **Design Robotics Group,** now **Material Processes and Systems (MaPS) Group**
Founded a research group centered on digital material systems and construction robotics. Raised low 6 digit amount over 5 years.

2013-2015 **Smart(er) Cities**
Investigates the future of health care and of learning in the context of the city of Bergamo, Italy.
Sponsor: Italcementi. Collaborating GSD faculty: Prof. Allen Sayegh, Nashid Nabian (until 2014).

2012-2013 **Smart Health**
The research develops strategies for using information technology in support of health and well-being.
Sponsor: Humana. Collaborating GSD faculty: Prof. Allen Sayegh.

2012 **Future of Learning**
This project investigates the relationship between information technology and spaces of learning in the context of Armenia.
Sponsor: Ayb Foundation, Yerevan, Armenia. Collaborating GSD faculty: Prof. Allen Sayegh.

2009 - 2011 **Low2No - Case Study**
This project researches the emerging role of a new type of design competition in shaping a broad national agenda in sustainable design and development.
Sponsor: Sitra, Helsinki, Finland.

2007-2009 **Light and Structures - Marble Fabrications**
This project focuses on the use of robotic waterjet technology in the production of innovative transparent marble structures.
Sponsor: International Masonry Institute. Collaborating GSD faculty: Monica Ponce de Leon and Wes McGee

2006 **Mobile Information Unit**
Design and fabrication of an interactive mobile kiosk for the Harvard University Art Museums.
Sponsor: Harvard University Art Museums. Collaborating GSD faculty: Prof. Allan Sayegh.

2006 - 2007 **Laser Scanning**
Researched and wrote several case studies on best practice in laser scanning.
Sponsor: General Services Administration. Doctoral student: Jordan Brandt.

2001 -2006 **Computer-Aided Design and Manufacturing of Surface Structures**
Research project on digital design and manufacturing technology of shells and folded plates using wood, ferrocement and other materials.
Sponsor: GSD Junior Faculty Grant. Euclid Chemical (material donations)

2001 - 2002 **Interactive Structures Module**
Developed an interactive online teaching tool in collaboration with the Harvard Center for Design Informatics.
Sponsor: Harvard University Provost Grant

1999 - 2003 **BuildingEnvelopes.org—Internet Portal, Harvard University Center for Design Informatics**
As project leader developed, in collaboration with the other team members, consultants and the sponsor, the concept of an on-line archive of information on Building Envelopes and Environmental Control Systems. Served on the scientific committee and was involved in strategic planning for the portal.
Sponsor: Permasteelisa, Vittorio Veneto, Italy.

## Publications

### Books and Book Chapters

Real-Time Robotics. In: Daas, M. and Wit, Andrew: *Towards a Robotic Architecture.* ORO Editions, Rafael. Forthcoming.

*Ceramic Prototypes – Design, Computation, and Digital Fabrication.* In: Informes de la Construccion. Vol. 68, No. 544. pp 91 – 102. 2016.

with Kane, A., and King, N., *Keramische Bausysteme.* Basel: Birkhäuser, 2015.

with Kane, A., and King, N., *Ceramic Material Systems.* Basel: Birkhäuser, 2015.

with Andreani, S., (Re)volving Brick: Geometry and Performance Innovation in Ceramic Building Systems Through Design Robotics. in: Gramazio, K. et. al. (Eds.) *Fabricate.* Gbt Verlag 2014.

Design Robotics: A New Paradigm in Process-Based Design. in: Oxman, R. *Theories of the Digital in Architecture.* Abingdon: Routledge/Taylor & Francis. 2014.

with D. Schodek, *Structures.* 7th edition, Upper River Saddle: Prentice Hall. 2013.

Product and Process Approaches. in: Piroozfar, P., and Piller, F. (Ed.): *Mass Customisation and Personalisation in Architecture and Construction.* Abingdon: Routledge/Taylor & Francis. 2013.

Design Robotics: New Strategies for Material Systems Research. in: Peters, B., and Peters, T. (Ed.): *Inside Smart Geometry*. Chichester: John Wiley & Sons. 2013.

Performalism or Performance-Based Design? Book Chapter in: Grobmann, Y., and Neuman, E.: *Performalism: Form and Performance in Digital Architecture*. London: Routledge. 2011.

*On Shells and Blobs*. reprint in: Corser, R.: *Fabricating Architecture: Selected Readings in Digital Design and Manufacturing.* Princeton Architectural Press. 2010.

A Continuous Challenge in Custom Construction. in: Girmscheid, G., Scheublin, F. (Ed.): *New Perspective in Industrialization in Construction - A State-of-the-Art Report. pp*. 53 - 66. ETH Zurich. 2010.

*Innovative Surface Structures.* Abingdon: Taylor & Francis. 2008.

Surface Structures in the Digital Age: Studies in Ferrocement. in: Lloyd-Thomas, K. *Material Matters,* London, Taylor & Francis. 2006.

with D. Schodek, K. Griggs, K. Kao, M. Steinberg, *Digital Design and Manufacturing: CAD/CAM Applications in Architecture and Design*. New York: J. Wiley & Sons. 2005.

## Journal Papers, Peer Reviewed

Bechthold, M., and Weaver, J.: *Material Science and Architecture*. In: Nature Reviews Materials. Reviewed, Accepted, Forthcoming.

Mayer, M., Espuig, Blanca D. and Bechthold, M.: *Energy Retrofit Tradeoffs in Residential Enclosures.* in Journal of the National Institute of Building Sciences, Vol. 5 No. 1 2017, pp. 14-18.

Bechthold, M., The Quest for Innovation: Methods and Mindsets. in: *International Journal of Architecture and Planning.* 2015, Vol. 2, No. 2, pp. 50 – 58. 2014

Park, D., Kim, P. Alvarenga, J., Jin, K., Aizenberg, J., Bechthold, M., Dynamic daylight control system implementing thin cast arrays of polydimethylsiloxane-based millimeter-scale transparent louvers. in: *Building and Environment*, 2014.

King, N., Bechthold, M., Kane, A., and Michalatos, P., Robotic tile placement: Tools, techniques and feasibility. in: *International Journal of Automation in Construction*, Vol. 39, 2014, pp 161 – 166.

Park, D., Bechthold, M., Designing Biologically Inspired Smart Building Systems: Processes and Guidelines. in: *International Journal of Architectural Computing*, Vol. 11, No. 4, 2013, pp. 437 – 467.

Bechthold, M., Wood-Foam Sandwich Shells: Computer-Aided Manufacturing of Complex Shapes. in: *International Journal of the Association of Shells and Spatial Structures*. 2002. pp 679 – 690.

## Conference Papers, Peer Reviewed

Mesa, O., Bechthold, M. et al.: *Non-Linear Matters: Auxetic Surfaces.* ACADIA 2017.

Andreani, S., and Bechthold, M., [R]evolving Brick: Geometry and Performance Innovation in Ceramic Building Systems through Design Robotics. in: *Fabricate 2014 Proceedings*, Zürich: ETH. 2014.

Mayer, M., and Bechthold, M., Fostering life cycle thinking in graduate education. In: *Proceedings of R+R 2013 Reclaim and Remake International Symposium*, Washington, DC. 11-13 April. 2013.

Bechthold, M. and King, N., Design Robotics: Towards Strategic Design Experiments. in: *RobArch 2012 Proceedings.* Vienna: Springer. 2012.

King, N., Bechthold, M., Kane, A., and Michalatos, P., Robotic Tile Placement: Tools, techniques and Feasibility. in *Proceedings ISARC 2012*, Eindhoven, June 2012.

Andreani, S., Garcia del Castillo, J. L., Jyoti, A. Jyoti, King, N., and Bechthold, M., Flowing matter: robotic fabrication of complex ceramic systems. in: *Proceedings ISARC 2012*, Eindhoven, The Netherlands.

M. Bechthold et. al., Integrated Environmental Design and Robotic Fabrication Workflow for Ceramic Shading Systems. in: *Proceedings of 28th International Symposium on Automation and Robotics in Construction (ISARC2011)*. Seoul. 2011.

Mayer M, Bechthold M, Ibanez M, Fabrication of Free-Form Sandwich Panels Using A Multi-Axis Water Jet Cutter. in: Ravichandran G (Ed.), *Proceedings of the 9th International Conference on Sandwich Structures*, California Institute of Technology. 2010.

New stone shells: design and robotic fabrication. in: *Evolution and Trends in Design, Analysis and Construction of Shell and Spatial Structures, IASS Proceedings*, Valencia, Spain.2009.

A Folded Arch – Experiments in Fiber-Reinforced Concrete. IASS Symposium Proceedings, December 2007: *Structural Architecture – Towards the future looking at the past.* Venice, Italy. 2007.

Teaching CAD/CAM – Pedagogy, Methods, Results. In: Kieferle, J, Ehlers, K. (Ed.) *Predicting the Future.* Proceedings, eCAADe 2007, Frankfurt, Germany

On Energy and Comfort: Design Strategies for Facades and Environmental Control Systems. in: Stanley, L (Ed.): *Emerging Technologies for High Performance Workplaces*; Washington DC: National Academy of Sciences, June 2002 (on CD). 2002.

## Other Publications

with Adriaenssens, S., Michalatos, P., Oxman, N., and Trummer, A.: Structural Delights: Computation, Matter, and the Imagination. in: *GAM 12 Structural Affairs*. 2016

*Keramik 2.0.* in architektur.aktuell, 12/2015.

*Ceramic Re:Vision.* In: architektur.aktuell. 1/2015.

Sayegh, A. and Bechthold, M, Hacking Science: The ALivE Group's Material Design Methods for Interdisciplinary Environments. in Menges, A. (Ed.) *Architectural Design special Issue: Material Synthesis: Fusing the Physical and the Computational.* 2015, Vol. 85, No. 5, pp 108 – 113.

RE:Birth of Materials. in: *MISC* Summer 2012, pp. 92-93

The Return of the Future: A Second Go at Robotic Construction. in: Oxman, R. and Oxman, R. (Ed): *New Structuralism: Design, Engineering and Architectural Technologies.* Architectural Design 4/2010.

More Bang for the Bucks. in: *GAM 06*. pp 128-139. No. 06. 2009

with W. Sobek, C. Lemaitre, D. Schönbeck, D*ance Space.* Cambridge, MA: Harvard University 2007

The Art of Structural Design: A Swiss Legacy. Book Review. in: *Harvard Design Magazin*. Fall 2004.

On Shells and Blobs. in: *Harvard Design Magazine*. pp 67-72. No. 19 Fall 2003 / Winter 2004

with K. Griggs: *Coffee, Cake, CAD/CAM: Reinventing the Urban Diner.* Cambridge, MA: Harvard University. 2002

with K. Griggs, D. Schodek, M. Steinberg: *New Technologies in Design II & III: Digital Design and Manufacturing Techniques* (Conference Proceedings); Cambridge, MA: Harvard University 2002

*Complex Shapes in Wood: Computer-Aided Design and Manufacture of Wood-Sandwich Roof Shells*; Cambridge, MA: Harvard University, 2001 (Dissertation)

with K. Griggs, D. Schodek, M. Steinberg (Ed.): *New Technologies in Design I: Digital Design and Manufacturing Techniques* (Conference Proceedings); Cambridge, MA: Harvard University. 2001

Complex Shapes in Wood: Computer-Aided Design and Manufacture of Roof Shells, in: M. Bechthold, K. Griggs, D. Schodek, M. Steinberg (Ed.): *New Technologies in Design: Digital Design and Manufacturing Techniques*; Cambridge (MA): Harvard University, 2001

## Patents

2 more US provisional Patents: KiriForm and Vascular Cooling Ceiling (both filed 3017)
US Provisional Patent No. 62/257,514: Adaptive Light Control System, filed 19 November 2015.
US Patent No. 61/727,543 Dynamic Light Redirection System, filed 16 November 2012

## Invited Lectures

September 2017: **Port Chester Clay Art Center**: Ceramic Systems

April 2017 **Fabricate 2017 Stuttgart**: Session Host

October 2016 B**arcelona Design Museum**: *Digital Craft: Ceramics*

April 2016 **NJIT, Hoboken, NJ,** *Material Systems.*

October 2015 **AIA USA, Miami**, *Ceramic Material Systems.*

October 2015, **Harvard SEAS,** *Material Systems.*

September 2015 **AIA Europe, Vienna**, *Ceramic Material Systems.* Keynote.

November 2014 **TU Graz**, *Happy Accidents.*

October 2014 **Bergamo Science Festival, Italy**, *Design | Science.* Keynote.

March 2014 **Conference on Architectural Ceramics, MIT, Cambridge,** *Digital Material Systems.*

June 2013 **Rhode Island School of Design, Providence RI,** *Material Systems.*

April 2013 **Texas Tech University, Lubbock TX,** *Design Robotics.*

March 2013 **Architecture Institute of Japan, Tokyo, Japan,** *Digital Material Systems: Research and Pedagogy.*

March 2013 **International Design Symposium, Kyoto, Japan,** *Research Design: Systems, Scales, Cultures.*

March 2013 **Toyohashi Institute of Technology, Japan,** *Design Robotics.*

February 2013 **California Polytechnic, San Luis Obisbo CA,** *Fabricating Structures.*

February 2013 **Lawrence Berkely Laboratories, Berkely CA,** *Ceramic Systems – Environmental Design to Robotic Production Workflow.*

October 2012 **Boston Society of Architects, Design within Designs,** *Ceramic Innovation.*

June 2012 **Technische Universität Graz, Austria,** *Design Experiments.*

March 2012 **Rensselear Polytechnic Institute, Troy NY,** *Microcosms: Design Experiments.*

February 2012 **Qualicer, Valencia, Spain**, *Ceramic Futures.* Keynote.

March 2011 **University of Buffalo,** *Microcosms: Design Experiments.*

Nov 2010 **City University of New York**, *Traces.*

Oct 2010 **Rhode-Island School of Design**, Providence RI, *Design Research.*

Oct 2010 **ETH Zurich, Architekturforum Zurich**, Switzerland, *The Return of the Future: A second Go at Robotic Fabrication.*

Sep 2010 **International Conference on Building Performance, Federal Ministry of Economics and Technology**, Berlin, Germany, *Experiments in Construction Automation.*

Mar 2010 **Stevens Institute of Technology**, Hoboken NJ, *Surface Structures.*

Feb 2010 **Yerevan State University**, Yerevan, Armenia, *Design Research*

Oct 2009 **Carnegie Mellon University**, School of Architecture, *Design Experiments.*

Aug 2009 **Keynote BTES Conference**, University of New Mexico, *New Catalysts in Architecture.*

July 2009 **Bauhaus Dessau**, *Advanced Studies @ Harvard GSD.*

April 2009 **Politecnico di Milano,** School of Architecture, Milan, *Parametric Fabrication.* Keynote.

Aug 2008 **Universidad Fransisco Marroquin,** School of Architecture, Guatemala City, *Emerging Fabrications.*

Apr 2007 **University of Hong Kong,** Department of Architecture, *CAD/CAM in Architecture.*

Apr 2007 **Chinese University of Hong Kong,** Department of Architecture, *The Quest for Thinness.*

2007 **Universidad de Los Andes**, School of Architecture, Mérida, Venezuela, *Beyond Representation – Design Research in Technology.*

Mar 2007 **Cranbrook Academy of Art,** Department of Architecture, *G 10*

2007 **IASS Symposium, Venice**, A Variable Fabrication Process – Experiments in Fibre-Reinforced Concrete.

Oct 2006 **Wiesbaden University of Applied Science,** Department of Architecture, Wiesbaden, Germany, *Materialgerechtigkeit – Prozessgerechtigkeit.*

Nov 2005 **SOM Building Science & Research Symposium**, Center for Architecture, New York City, *Wood Revisited.*

Oct 2005 **Expo Cihac,** National Trade Fair in Mexico City, Mexico, *Concrete Technologies.*

Oct 2005 **rethinking the architectural world: digital design,** Iberoamericana School of Architecture, Mexico City, Mexico, *Parametrics – Towards a New Paradigm in Architectural Production.*

May 2005 **Fehnsymposium**, Domkirkeodden, Hamar and Oslo School of Architecture and Design, Norway, *Wood Revisited* and (with Birger Sevaldson) *Digital Design and Fabrication in Architecture - Shifting Paradigms.*

Jun 2002 **New Technologies in Architecture III: Digital Design and Manufacturing Techniques**, Rakennusteollisuus Rty, Helsinki, Finland, Customization in Building Construction, *Integrating Digital Design and Manufacturing.*

Nov 2001 **New Technologies in Architecture II: Digital Design and Manufacturing Techniques**, GSD, Department of Architecture, Cambridge, MA. Co-organizer and moderator

Nov 2000 **Real Estate, Construction, and the Internet**
Harvard Center for Design Informatics & GSD Office of Executive Education, Cambridge, MA, *BuildingEnvelopes.org - Yet Another Portal.*

Oct 2000 **New Technologies in Architecture I: Digital Design and Manufacturing Techniques**
GSD, Department of Architecture, Cambridge, MA; Co-organizer and speaker, *Complex Shapes in Wood: Computer-Aided Design and Manufacture of Roof Shells.*

Oct 2000 **Semi-Annual BuildingEnvelopes.org Meeting**
Center for Design Informatics; Venice, Italy, *BuildingEnvelopes - a Portal on Sustainable Design*.

## Workshops, Reviews, Exhibitions

**Invited Workshops:**

Sydney University, RobArch 2016
University of Navarra, Pamplona, 2014
University of Michigan, RobArch 2014
Wiesbaden University of Applied Science
Dessau Institute of Architecture

Inha International Workshop, Incheon, South Korea
RPI Troy NY: Smart Geometry 2012
Graz/Vienna, Austria: RobArch 2012
Toyohashi, Japan

**Exhibitions:**

Cevisama Valencia, Spain (2012, 2013, 2014, 2015, 2016, 2017)
Green Expo Vienna, Austria (2014)
MADE Milano, Italy (2013)

**Reviews:**

Invited juror for studio and course reviews at Yale University, University of Pennsylvania, MIT, Toyohashi University of Technology (Japan), Yerevan State University (Armenia), Ohio State University, and many others.

**Competition Juries:**

Cambridge, MA, 2015, Kendall Square EcoDistrict Bike Parking Competition. Advisor.
Jeddah, Saudi Arabia, 2014. Urban Public Transport System.
Kaoshing, Taiwan, 2012. Conference Center.
Samsung, 2011. Point and Shoot Ideas Competition.

## Scholarships, Awards, Honors

2015 **Autodesk BUILD Grant**

2014 **ACADIA National Innovative Research Award**

2013 – present **Member of the International Advisory Board** for the Collaborative Design Program at Kyoto University, Japan.

2010 – 2012 **Member of the Advisory Board** at Wentworth School of Architecture, Boston MA.

2010 **Honorary Doctoral Degree**, State University of Yerevan

2010 **Ayb Foundation Grant** to fund a student field trip to Armenia

2007 **Harvard Asia Center**, Grant to fund field research on robotics in Japan

2007 **Harvard Graduate School of Design**, Dean's Grant: Funds research on architectural robotics.

2006 **German Academic Exchange Program**, Grant to fund a group field trip to Germany.

2005 **Harvard Graduate School of Design**, Junior Faculty Travel Grant: Funds field research on and photogrammetric documentation of concrete shells in Mexico, Switzerland, Spain and Germany.

2003 **Tsuboi Award**, International Association of Shells and Spatial Structures

2002 **Harvard Graduate School of Design,** Junior Faculty Research Grant: Funds Research on Ferrocement

2001 **Harvard Provost Grant** for "Innovation in Instructional Computing"

2000 **Peter Rice Prize,** Harvard University, GSD

1999 **Snyder Prize for Innovation in Fabrication and Manufacturing** Harvard University, GSD

1988 **German Academic Exchange Program (DAAD) Scholarship** DAAD

## Professional

2009 **Private Residence**, Cambridge MA. Private Project.

2005 - 2007 **Contract Furniture**, Corinto srl, Italy. Private Commission.

2007 - 2008 **In der Blume Residence,** Heiligenhaus, Germany. Private Commission.

2004 **Timber Arch Bridge**, Lilliesleaf, Scotland. Private Commission.

1996 - 2004 Various competitions and private commissions.

1997 - 1998 **Entertainment Center, Hamburg, Germany**
Project Architect von Gerkan, Marg & Partner
Multiplex cinema with entertainment facilities, food court, car showroom, gas station and parking garage. Designed the project and lead the team throughout all phases, including design development, detailing, specification revisions and site supervision. Largest bolted glazing façade in Germany in 1998. Coordination of consultants and engineers.

1995 - 1997 **Lenne-Passage, Frankfurt (Oder), Germany**
Project Architect von Gerkan, Marg & Partner
Large, urban mixed use building, including retail, office, hotel and parking. Conceptual design, design development and construction documents. Coordination of all design consultants etc.

1994 **Auditorio di Tenerife, Canary Islands, Spain**
Project Architect S. Calatrava
Concert hall with facilities for operas and a chamber music hall. Design Development and tender documents including details and construction documents; collaboration and coordination of engineers; detailed development of concert space with S. Calatrava and acoustic engineer, involving frequent trips to Spain.

1993 **Conversion of Reichstag into German Parliament**
Project Architect S. Calatrava
Competition in two phases, involving a team of up to 21 people in the office. Won joint first prize with two other offices.

1992 **Pre-school and Kindergarten Flassans, France**
Collaboration with Saget Bonnemaison Architectes DPLG, Paris
Prepared complete set of construction documents and details for a mixed concrete/steel building.

1992 **Pre-School and Kindergarten Paris, France** Collaboration with Leonard Weissmann Arch., Paris
Conceptual design in collaboration with the office partners.

## Professional Organizations

2003 – 2014 International Association of Shells and Spatial Structures (IASS)

2000 - 2005 Society of Manufacturing Engineers, USA

1994 – present Chamber of Architects of Northrhein-Westphalia, Germany