Citation:
Co-Robotics and Construction
Rust Belt Robotics Group

Imagine a bustling construction site where robots do most of the tradesmen's dirty work, so to speak—hauling materials, climbing ladders, and navigating scaffolding. Assistant professor of architecture Michael Silver is leading the multidisciplinary Rust Belt Robotics Group at the University at Buffalo, State University of New York, to develop humanoid robots that interact with people in dynamic environments.

Though many researchers are in the race to develop construction robots, Silver, a self-taught roboticist, and his team are consulting with contractors, tradespeople, and trade unions to ensure their robots add value to the industry. His research in co-robotics—meaning that the machines work alongside people and not in isolation—focuses on making people more productive and profitable.

In the past two years, Rust Belt Robotics has built three generations of small-scale, but increasingly complex, android prototypes coined On-Site Construction Robots (OSCR, pronounced "Oscar"). The first OSCR lifted a lightweight, 3D printed ABS-plastic brick, took a few steps, and then set the brick down in a precise spot. OSCR-2 (bottom left) lifted three ABS bricks and stepped up a 1-inch-tall riser. The third OSCR (top left) walked on four legs for greater stability and strength, carried and deployed lightweight but standard-size bricks. It also navigated the group's laboratory space and tracked other color-coded bricks using a video camera.

Now the team is building its fourth prototype—a bipedal robot that can use its hands to grip and stack waterjet-cut sandstone blocks. Enabled with Wi-Fi, this larger machine will combine the capabilities of the previous OSCRs with the ability to 3D scan a site and communicate information and photographs back to the humans it is assisting. Silver also wants to increase the intelligence and functionality of the robots by programming them to transmit BIM data via the cloud. Rust Belt Robotics is now leading a three-year effort to deploy an OSCR to an actual jobsite.

Juror Steven Rainville applauded the group for diving into such a competitive research area that shows promise in altering the future of the construction industry. "This is really cool to me," he said. —J.J.

Judges

French architect **Marc Fornes** is the principal and founder of TheVeryMany in New York, as well as a self-described connoisseur of computer science. His work focuses on investigating design through codes and computational protocols. He received a master of architecture and urbanism from the Architectural Association School of Architecture in London.

Joyce Hwang, AIA, is an associate professor of architecture at the University at Buffalo, the State University of New York, and the director of Ants of the Prairie, a research and practice firm in Buffalo, N.Y., that confronts contemporary ecological conditions through creative means. She received an M.Arch. from Princeton University and a B.Arch. from Cornell University.

Steven Rainville, AIA, is a principal at Seattle-based Olson Kundig Architects, which he joined in 1996. He is also the director of the firm's R&D department as well as the founder of Mind Mine, the firm's forum for crowd-sourced ideas that break down boundaries between industries. He received his B.Arch. from Washington State University.

Credits

Pulp Pavilion, page 104
Client: Coachella Valley Music and Arts Festival
Design Firm and Fabricator: Ball-Nogues Studio, Los Angeles · Gaston Nogues, Benjamin Ball, ASSOC. AIA (project leads/designers); Rafael Sampaio Rocha (project manager); Ricardo Garcia, John Guinn, Fernando Marroquin, Rafael Sampaio Rocha, Forster Rudolph, Corie Saxman, Nicole Semenova, Ethan Schwartz (onsite project team); Andrew Fastman, AIA, Michael Anthony Fontana, Cory Hill, James Jones, Mora Nabi, Jacob Patapoff, Allison Porterfield (support)
Lighting Programming: F. Myles Sciotto
Structural Engineer: Nous Engineering · Omar Garza
Funding: Commission from Goldenvoice
Size: 1,300 square feet

Pure Tension Pavilion, page 108
Client: Volvo Car Italia
Design Firm: Synthesis Design + Architecture, Los Angeles · Alvin Huang, AIA (principal); Filipa Valente, Chia-ching Yang, Behnaz Farahi, Yueming Zhou
Structural Engineer: BuroHappold Engineering
Electrical Engineer: Ascent Solar

Bar Raval, page 110
Client: Grant van Gameren, Mike Webster, and Robin Goodfellow
Design Firm: Partisans, Toronto · Alexander Josephson, Pooya Baktash, Jonathan Friedman, INTL. ASSOC. AIA, Ivan Vasyliv, Ariel Cooke
Consultant and Fabricator: Millworks Custom Manufacturing
Special Thanks: Klaudiusz Kociolek, Gregory Rybak, Nick Savage, CNC Software/Mastercam
Size: 1,500 square feet

Co-Robotics and Construction, page 112
Design Firm: Rust Belt Robotics Group, University at Buffalo, State University of New York (SUNY)
OSCR-1 and OSCR-2 Team: Ball State University · Mike Silver, Mahesh Daas, Josh Vermillion (faculty); Yevgen Monakhov, Jason Foley, Matthew Fullenkamp, ASSOC. AIA, William Zyck, Justin Krasci, Michael Bolatto, Tyler Cox, ASSOC. AIA, Glenn Cramer, ASSOC. AIA, Robert Cichocki, Antone Sgro, Derek Anger, Tianxia Peng, Derek Newman, David Smith, Yao Xiao, Matthew Wolak, Thomas Friddle (students)
OSCR-3 Team: University at Buffalo, SUNY Team · Mike Silver, Karthik Dantu (faculty); Colin Jacobs, Tim Ruhl, Albis Del Barrio, David Heaton, Gary Chung, David Lin, Georine Pierre, Robert Miller, Johnny Lynch, Daniel Fiore, Dylan Burns, Jia Jian Feng You, Marc Velocci (students)

Queen Richmond Centre West, page 113
Client and Funding: Allied Properties REIT
Design Firm: Sweeny &Co Architects, Toronto
Structural Engineer: Stephenson Engineering
Fabricators: Cast Connex, Walters Group
Construction Management: Eastern Construction
Electrical Engineer and Lighting Designer: Mulvey & Banani International
Mechanical Engineer: The Mitchell Partnership
Special Thanks: Michael Emory, Hugh Clark, John Stephenson, Jeffrey Stephenson, Carlos de Oliveira, Frank DeCaria, Renato Tacconelli, Tim Verhey
Size: 302,000 square feet

Radical Railbanking, page 114
Design Team: Master of None, Ann Arbor, Mich. · McLain Clutter (project adviser); Sehee Kim (student research assistant)
Funding: University of Michigan Office of Research, funding for Artistic Productions and Performances, 2011; University of Michigan Taubman College of Architecture and Urban Planning
Special Thanks: Syracuse University School of Architecture · Mark Linder

Bands, page 115
Client: Samitaur Constructs · Frederick and Laurie Samitaur Smith
Design Firm: Eric Owen Moss Architects, Culver City, Calif. · Eric Owen Moss, FAIA (architect); Dolan Daggett, Vanessa Jauregui, Nicholas Barger, Zarmine Nigohos, Sean Briski, Raul Garcia, Scott Nakao, Richard Yoo (project team)
Structural Engineer: Arup
Size: 183,000 square feet

Philip J. Currie Dinosaur Museum, page 116
Client: Philip J. Currie Dinosaur Museum
Design Firm: Teeple Architects, Toronto · Stephen Teeple, Martin Baron, Mark Baechler, Will Elsworthy, Lang Cheng, Carla Pareja, Gloria Perez
Architect of Record: Architecture | Tkalcic Bengert
Structural Engineer: Fast + Epp
Mechanical Engineer: Hemisphere Engineering
Electrical and Civil Engineer: AECOM
Exhibit Consultant: Reich+Petch
Landscape Architects: Scatliff+Miller+Murray
LEED Consultant: Enermodal Engineering (now part of MMM Group)
Contractor: PCL Construction Management
Fabricators: StructureCraft Builders in collaboration with Fast + Epp
Size: 42,000 square feet

Breathe Brick, page 117
Design Firm: Both Landscape and Architecture, Charlottesville, Va. · Carmen Trudell (primary investigator)
Collaborators: California Polytechnic State University, San Luis Obispo (Cal Poly) · Tracy Thatcher (consultant); Natacha Schnider, Kate Hajash, Cameron Venancio, Justin Wragg, Jennifer Thompson, Michelle Kolb (student research assistants); Rensselaer Polytechnic Institute · Kateri Knapp, Kyleen Hoover (student research assistants)
Funding: Cal Poly College of Architecture and Environmental Design's Planning, Design and Construction Institute