

## CV Juan Cristóbal Zagal

### Personal Data

Name Juan Cristóbal Zagal			
Institution Department of Mechanical Engineering, School of Matematics and Physics, University of Chile			
Current position Assistant Professor			
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### Curricular Data

Education/Training	Institution	Date
Postdoc	Cornell University, Ithaca, NY, USA	2010
Ph.D. in Automation	University of Chile, Santiago, Chile	2007
M.Sc. Scientific Computing	Royal Institute of Technology, Stockholm, Sweden	2002
P.E. Electrical Engineering	University of Chile, Santiago, Chile	2000

### Professional/Scientific Society Activities

Position	Institution	Dates
Founder/Director	Fab Lab University of Chile <b>fablab.uchile.cl</b>	Since 2011
Founder/Director	Laboratorio de Síntesis de Máquinas Inteligentes	Since 2011

### Professional Experience

Position	Institution	Dates	FT/PT
Assistant Professor	University of Chile, Dept. Mechanical Engineering.	05/10 – to date	Full-time
Postdoctoral Researcher	Cornell University, Mechanical & Aerospace Eng.	07/08 – 04/10	Full-time
Postdoctoral Researcher	CINV, Dept. of Physiology.	12/07 – 06/08	Full-time
System Engineer	European Org. for Astronomical Research, Garching-Paranal	04/04 – 07/07	Full-time
Research Assistant	Universidad de Chile, Dept. Electrical Engineering.	03/03 – 12/06	Part-time
Researcher Engineer	Royal Institute of Technology (KTH), Robotics Laboratory.	09/99 – 11/02	Full-time

### Reviewer/Consultant for International and National Funds

1. **World Bank**, Consultant on Digital Fabrication and Innovation for East Europe (2013-14).
2. **ECLAC, United Nations**, Consultant Focal Point on Digital Fabrication (2014).
3. **Innova, Corfo, Chile**, Reviewer (2012-14).
4. **Fondecyt, Fondef, Conicyt, Chile**, Reviewer (2014).
5. **Agencia Nacional de Investigación e Innovación, Uruguay**, Reviewer, (2013).

### Honors/Awards

1. **ROBIO 2016 Best Paper Finalist Award** IEEE Conference on Robotics and Biomimetics, Qingdao, China, 2016.
2. **SCR2016 Best Poster Award** at the Southern California Robotics Symposium, San Diego, CA, USA, 2016.
3. **RoboCup Engineering Challenge Award 2004: A best paper award**, out of 118 papers, at RoboCup International Conference, Lisbon, Portugal, 2004.
4. **STINT Fellow**: Awarded by the Swedish Foundation for International Cooperation on Research and Higher Education 2001 and 2002.
5. **NHI Human Brain Mapping Award 2000**: Award for the best (10%) papers presented at HBM conference, San Antonio, Texas, USA, 2000.
6. **SFSR Research Fellow**: Awarded by Swedish Foundation for Strategic Research for doing research in Medical Image Analysis at CVAP/CAS KTH (2001 - 2002).
7. **Graduated with Maximum Distinction**, 2000, Dept of Electrical Engineering, University of Chile.

### Journal / Conference reviewer. Chair/Keynote Speeches

1. **Journal Reviewer (17 International Journals)**:
  - IEEE/ASME Transactions on Mechatronics,
  - IEEE Transactions on Systems, Man, and Cybernetics Part B,
  - IEEE Transactions on Autonomous Mental Development,
  - IEEE Transactions on Cybernetics,
  - Robotics and Autonomous Systems,
  - Applied Mathematical Modeling,
  - Rapid Prototyping Journal,
  - Mechatronics Journal,
  - Mechanism and Machine Theory,
  - International Journal of Humanoid Robotics,
  - Journal of Intelligent and Fuzzy Systems,
  - Robotica Journal,
  - Automation in Construction,
  - Journal of Intelligent and Robotic Systems,
  - International Journal of Robotics and Automation,
  - International Journal of Advanced Robotic Systems,
  - Majlesi Journal of Electrical Engineering.
2. **Conference Reviewer**: 2012 International Conference on Advanced Information Technology and Sensor Application, 2013 International Conference on Advanced Robotics (ICAR2013), IROS 2016.
3. **Keynote Speeches**: **ECAL 2009**: European Conference on Artificial Life, September 2009, Budapest, Hungary. Keynote, given by H. Lipson, about our research on Self-Reflective Machines. **PerMIS 2009**: Performance Metrics for Intelligent Systems, September 2009, Gaithersburg, USA. Invited as a panel discussion member, subject: "Theory of Mind for Machines". **Machines and Organisms 2009**: Invited to give a conference on the subject of "Self-Reflective Machines", October 2009, Cornell University, Ithaca, USA.

## **Publications**

**Author Citation Counts:** 479 citations Scholar (h-index 11)

## **Journals**

A.Vergara, Y. Lau, R.F. Mendoza-Garcia, J.C. Zagal, “Soft Modular Robotic Cubes: Toward Replicating Morphogenetic Movements of the Embryo”, *PLoS ONE*, 12(1): e0169179, 2017, **IF 3.057**.

E. Escobar, M. Diaz, J.C. Zagal, “Evolutionary Design of a Satellite Thermal Control System: Real Experiments for a CubeSat Mission”, *Applied Thermal Engineering*, vol 105, pp. 490-500, 2016, **IF 3.043**.

M. Diaz, J.C. Zagal et al. “New opportunities offered by CubeSats for space research in Latin America: the SUCHAI project case”, *Advances in Space Research*, vol 58, 10, pp. 2134-2147, 2016.

S. Li, J. Yuan, Y. Shi, J.C. Zagal, “Growing Scale-Free Networks with Tunable Distributions of Triad Motifs”, *Physica A: Statistical Mechanics and its Applications*, 428, 103-110, 2015, **IF 1.785**.

A. Calderon, J. Griffin, J.C. Zagal, “BeamMaker: An Open Hardware Digital Fabricator for the Masses,” *Rapid Prototyping*, vol 20, 3, 245-255, 2014, **IF 2.031**.

J. C. Zagal, J. Delpiano, and J. Ruiz-del-Solar, “Self-modeling in humanoid soccer robots,” *Robotics and Autonomous Systems*, vol. 57, no. 8, pp. 819–827, 2009.

G. Herrera, J. C. Zagal, M. Diaz, M. J. Fernandez, A. Vielma, M. Cure, J. Martinez, F. Bozinovic, and A. G. Palacios, “Spectral sensitivities of photoreceptors and their role in colour discrimination in the green-backed firecrown hummingbird,” *Journal of Comparative Physiology A*, vol. 194, no. 9, pp. 785–794, 2008, **IF 2.014**.

J. C. Zagal and J. Ruiz-del-Solar, “Combining simulation and reality in evolutionary robotics,” *Journal of Intelligent and Robotic Systems*, vol. 50, no. 1, pp. 19–39, 2007.

J. C. Zagal, I. Sarmiento, and J. Ruiz-del-Solar, “An application interface for UCHILSIM and the arrival of new challenges,” vol. 4020 *Lecture Notes in Computer Science*, pp. 464–471, Springer, 2007.

J. C. Zagal and J. Ruiz-del-Solar, “UCHILSIM: A dynamically and visually realistic simulator for the RoboCup four legged league,” vol. 3276 *Lecture Notes in Computer Science*, pp. 34–45, 2005.

J. C. Zagal, J. Ruiz-del-Solar, P. Guerrero, and R. Palma, “Evolving visual object recognition for legged robots,” vol. 3020 *Lecture Notes in Computer Science*, pp. 181–191, 2004.

J. C. Zagal and J. Ruiz-del-Solar, “Learning to kick the ball using Back-to-Reality”, vol. 3276 *Lecture Notes in Computer Science*, pp. 335–346, 2005.

J. Ruiz-del-Solar, J.C. Zagal, “How contests can foster the research activities in developing countries: Chile – A case study”. vol. 3020, *Lecture Notes in Computer Science*, pp. 748-756, 2004.

## **Conference Proceedings**

A.A. Calderon, Joakin Ugalde, J.C. Zagal, N.O.Perez-Arancibia, “Design, Fabrication and Control of a Multi-Material–Multi-Actuator Soft Robot Inspired by Burrowing Worms”. IEEE International Conference on Robotics and Biomimetics, IEEE ROBIO, Qingdao, China, 2016.

A.A. Calderon, J.C. Zagal, N.O.Perez-Arancibia, “A Pneumatically-Driven Soft Robot Biologically Inspired by Earthworms”, Southern California Robotics Symposium, SCR2016, San Diego, CA, 2016.

- R.F. Mendoza-Garcia, H.R. Valenzuela-Coloma, Y.-s. Lau-Cortes, J.C. Zagal, “Mentaca: An Universal Jamming Gripper on Wheels”, IEEE Congress Chilecon, Santiago, Chile, 2016.
- J.C. Zagal *et al.* “Fab Lab as an Implementation Tool of the CDIO Program”, in Proceedings of the 9th International CDIO Conference, Massachusetts Institute of Technology and Harvard University, Cambridge, Massachusetts, June 9 – 13, 2013.
- K. Glette, G. Klaus, J.C. Zagal, J. Torresen, “Evolution of Locomotion in a Simulated Quadruped Robot and Transferal to Reality”, In Proceedings of the Seventeenth International Symposium on Artificial Life and Robotics, ISAROB, Japan, 2012.
- J. Mardones, G. Iori, A. Becerra, M. Diaz, J.C. Zagal, “Using Digital Fabrication on Small Satellite Projects”, In Proceedings of the International Symposium on Small Satellites Systems and Services, 4S Symposium”, Portoroz, Slovenia, 2012.
- A. Becerra, M. Diaz, J.C. Zagal, “Feasibility Study of Using Small Satellite Constellation to Forecast, Monitor and Mitigate Natural and Man-Made Disasters in Chile and Similar Developing Countries”, In Proceedings of the 26<sup>th</sup> Annual AIAA/ASU Conference on Small Satellites, USA, 2012.
- E. Escobar, M. Diaz, J.C. Zagal, “Design Automation of Passive Thermal Control for CubeSat”, In Proceedings of the International Symposium on Small Satellites Systems and Services, 4S Symposium”, Portoroz, Slovenia, 2012.
- J.C. Zagal, C. Armstrong, S. Li, “Deformable Octahedron Burrowing Robot”, In ALIFE XIII: Proceedings of the Thirteenth International Conference on the Simulation and Synthesis of Living Systems, Michigan, USA, 2012.
- F. Torres, J.C. Zagal, “Automated Synthesis of Locomotion Controllers for Self-Reconfigurable Modular Robots”, In From Animals to Animats 12: Proceedings of the Twelve International Conference on Simulation of Adaptive Behavior, Denmark, 2012.
- S. Li, J. Yuan, and J. C. Zagal, “Encouraging Networks Modularity by Seeding Motifs,” In the European Conference on Artificial Life , ECAL 2011, Paris, France, August 2011.
- Yosinski J, Clune J, Hidalgo D, Nguyen S, Zagal J.C., Lipson H. “Evolving Robot Gaits in Hardware: the HyperNEAT Generative Encoding Vs. Parameter Optimization” Proceedings of the European Conference on Artificial Life, 2011.
- Yosinski J, Clune J, Hidalgo D, Nguyen S, Zagal J.C., Lipson H. “Generating Gaits for Physical Quadruped Robots: Evolved Neural Networks Vs. Local Parameterized Search”, In Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2011, 2011.
- J. C. Zagal and H. Lipson, “Resilient behavior through controller self-diagnosis, adaptation and recovery,” in PerMIS’09: Performance Metrics for Intelligent Systems Workshop, National Institute of Standards and Technology, Gaithersburg, Maryland, USA., September 2009.
- J. C. Zagal and H. Lipson, “Towards self-reflecting machines: Two-minds in one robot,” in ECAL 2009: Tenth European Conference on the Simulation and Synthesis of Living Systems, Budapest, Hungary, 2009.
- J. C. Zagal and H. Lipson, “Self-reflection in evolutionary robotics: Resilient adaptation with a minimum of physical exploration,” in GECCO 2009: Proceedings of the Genetic and Evolutionary Computation Conference, Late Breaking Papers, Montreal, Canada, pp. 2179–2188, 2009.
- J. C. Zagal, J. Ruiz-del-Solar, and A. G. Palacios, “Fitness based identification of a robot structure,” in Artificial Life XI: Proceedings of the Eleventh International Conference on the Simulation and Synthesis of Living Systems, pp. 733–741, MIT Press, Cambridge, MA, 2008.
- M. Scholler, - Several Authors -, and J. C. Zagal, “Recent progress at the very large telescope interferometer,” in Advances in Stellar Interferometry, vol. 6268 of Proceedings of SPIE, The International Society for Optical Engineering, 2007.

### Popular Science

Charles Q. Choi. “Automation, Know Thyself: Robots Become Self-Aware”, in *Scientific American*, February 2011.  
[Article about my research together with H. Lipson on Self-Reflective Machines].

### **Teaching:**

ME704 Robotics and Design Automation, EL710 Introduction to Mobile Robotics, EI2001 Taller de Proyecto, ME56B Taller de Diseño Mecánico, ME4030 Seminario de Diseño e Innovación Tecnológica, ME5601 Diseño de Sistemas Mecánicos, ME4705 Digital Fabrication, ME4.

### **Participation in science & development projects indicating source(s) of funds, period of funding and category within the project.**

P.I. ONR-G Award N62909-16-1-2164, “Soft Modular Robots”, 2016-18, US\$225,000.

Co-P.I. Fondecyt Regular 1151476, “Cubesat Platform for Space and Technology Research”, 2014-2018, US\$400,000.

Co-P.I. Fondecyt EQM140012, “Diseño y fabricación de biomateriales con porosidad y forma controlada mediante adquisición de un equipo de prototipado rápido”, 2014/2016, US\$300,000.

P.I. Fondecyt 3080048 (2007-2009) “Embodied Robot Simulation as an Enactive Approach to the Understanding of Cognition”, US\$ 60K.

P.I. Fondecyt 11110353 (2011-2014) “Self-Reflecting Machines: Instilling Robots with the Ability to Reflect on their Own Thinking”, US\$ 100K.

Co-P.I. ANR-Conicyt ANR-47 (2010-2013) “KEOpS Algorithms for modeling the visual system: From natural vision to numerical application”, US\$ 300K.

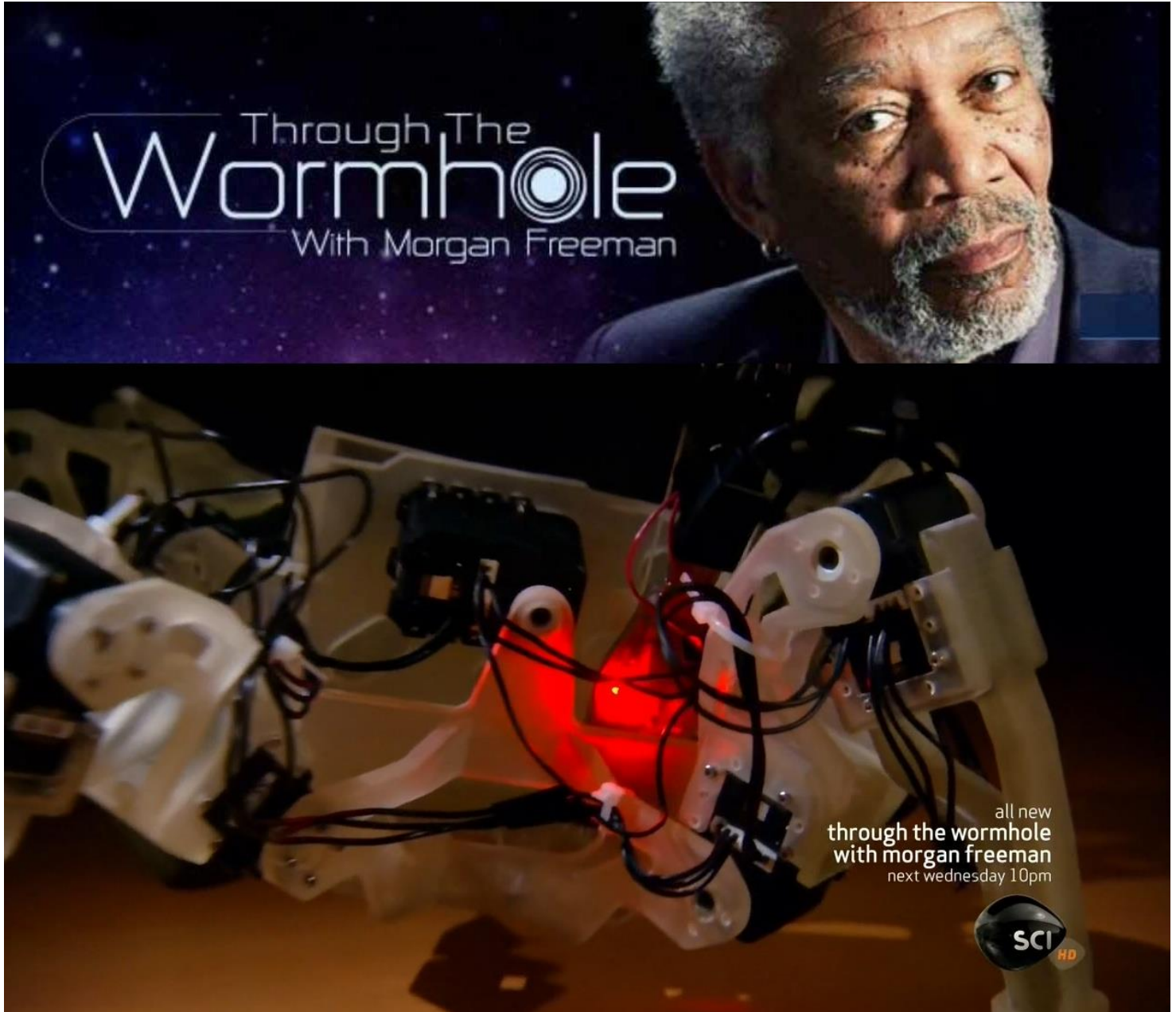
Co-P.I. FCFM Funding, “Design, construction, launch and operation of a CubeSat (SUCHAI Project)”. ( 2010-2013), US\$ 500K.

P.I. MECESUP FIAC2 UCH1102. Fab Lab U. de Chile. Innovación en la Formación en Ingeniería y Ciencias usando el enfoque CDIO. (2012-2014), US\$ 400K.

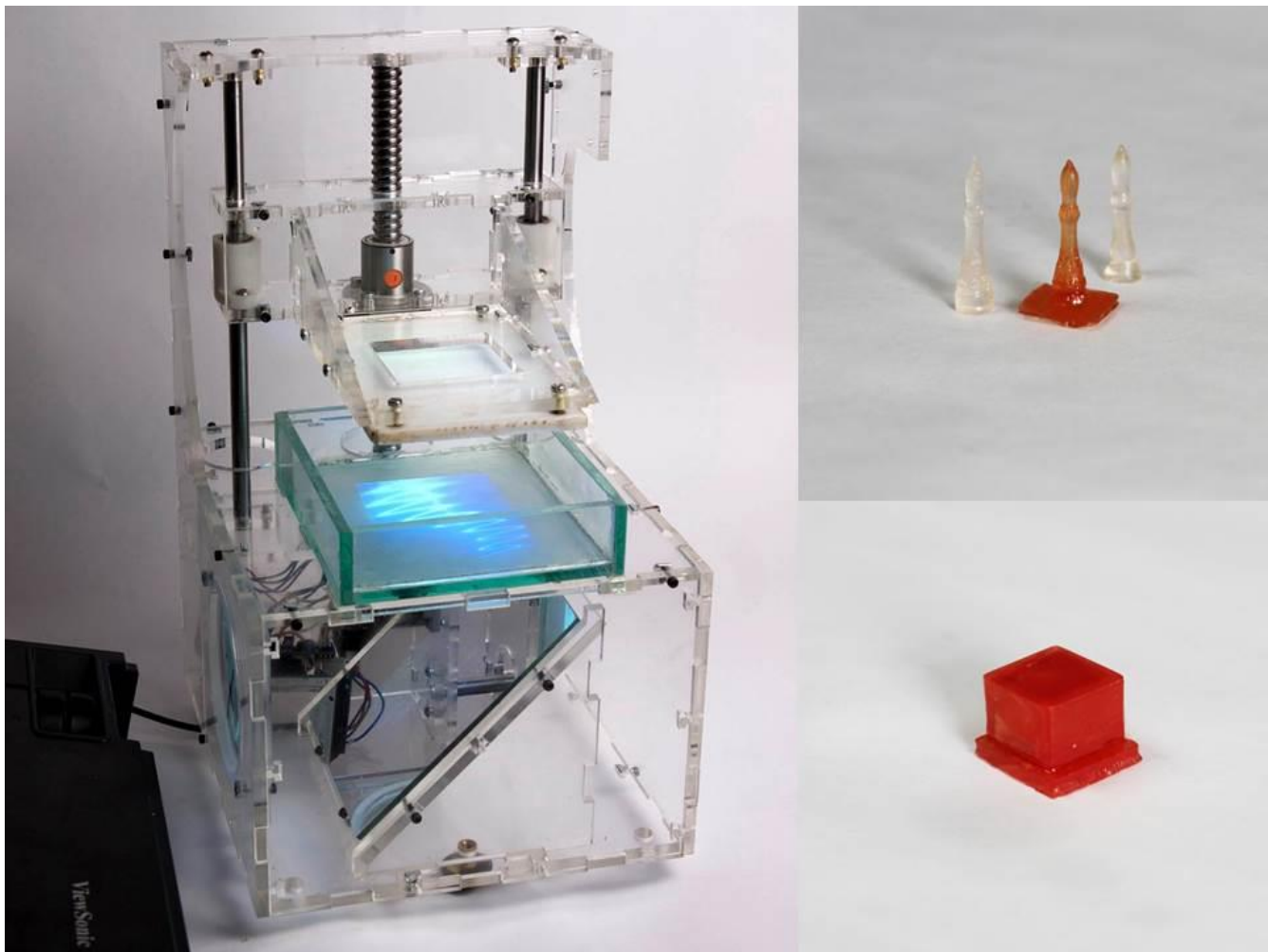
P.I. U-Inicia (2010-2012) “Machine Self-Reflection”, US\$ 30K.

10.- Representative Images

QuadraTot robot designed by myself, is cover of Morgan Freeman TV show “Through the Wormhole”

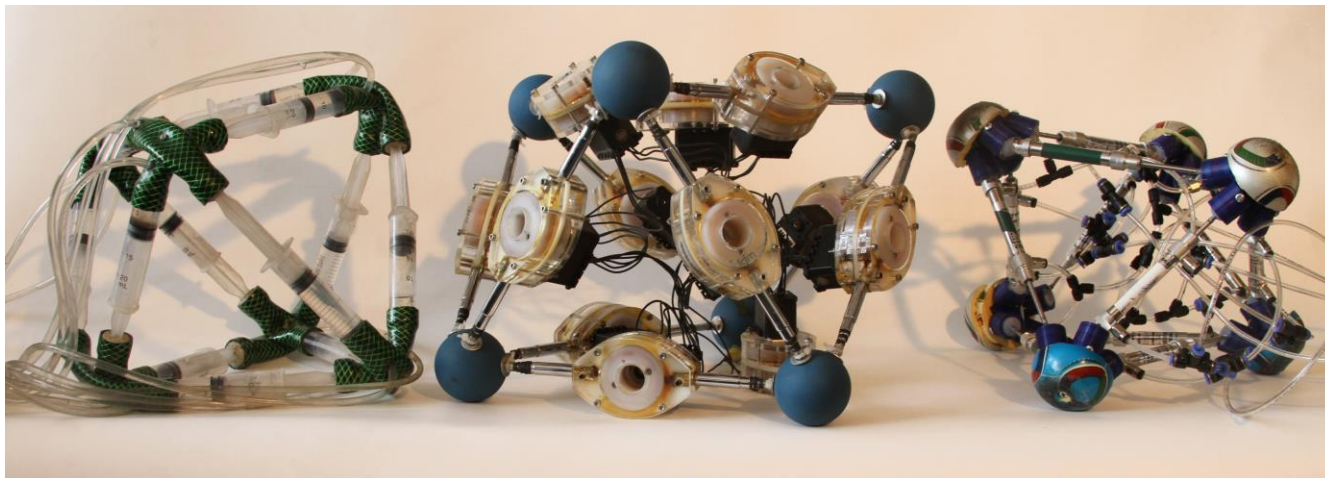


**Illustration of BeamMaker 3D printer**

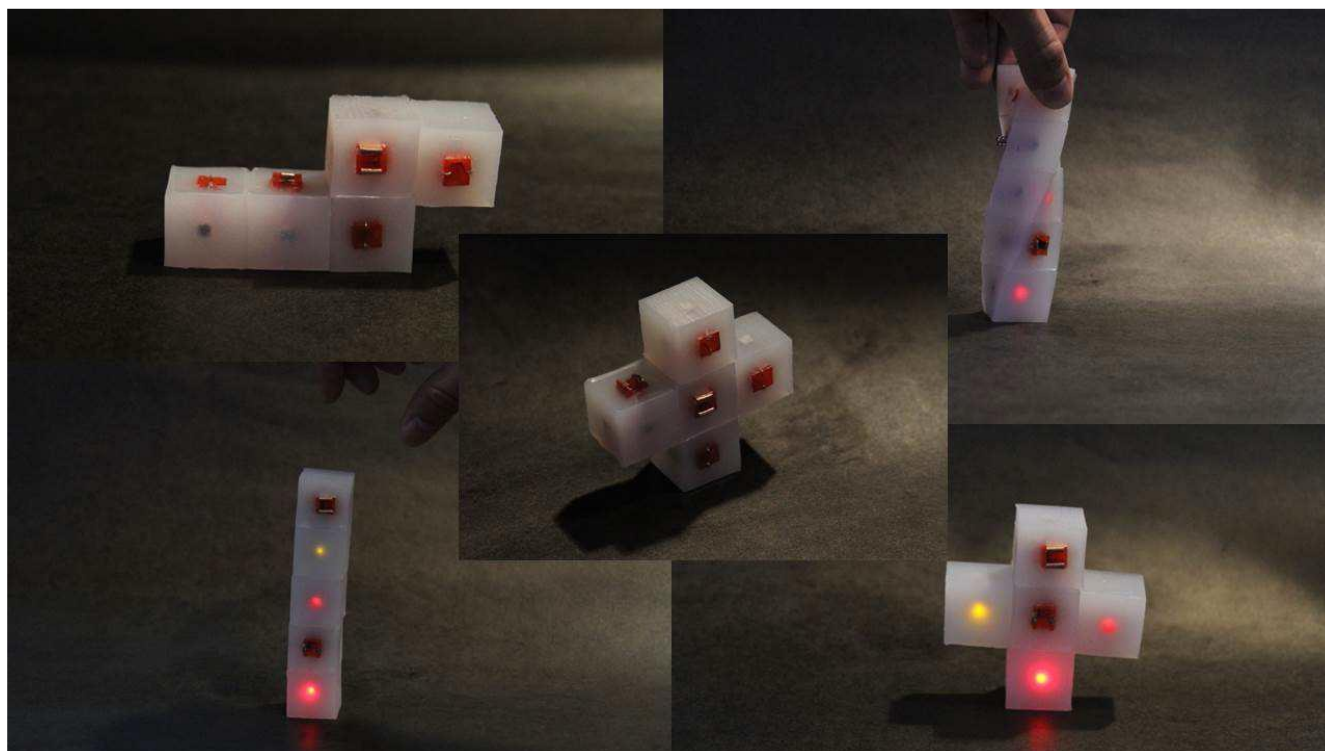




**Illustration of Octahedral Deformable Robots**



**Example of Research in Soft modular robots and soft sensors**





**Example of Research in Programmable Matter**

