

## Summary

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**PhD in Engineering Science with strong analytical, prototyping and fabrication skills** - involving lamination based Printed Circuit-MicroElectroMechanical Systems (PC-MEMS) fabrication techniques, laser machining, CNC machining, 3D printing, mill and lathe, hardware interface and design, mechanism design and system modeling

- **Independent problem solver**
- **Methodical troubleshooter**
- **Proficient communicator**
- **Adept collaborator**

## Education

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*Ph.D. in Engineering Science. Harvard University* 2015  
Design of Hybrid Passive and Active Mechanisms for Control of Insect-Scale Flapping-Wing Robots  
*M.S. in Aeronautics and Astronautics. Stanford University* 2011  
*B.S. in Mechanical Engineering. Cornell University, Cornell Engineering Learning Initiatives grant* 2009

## Research Experience

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### Harvard University

*Postdoctoral fellow* advised by Robert J. Wood 2015 -present

- Modified the transmission of an Insect-Scale Flapping-Wing (ISFW) robot to perform aggressive heading maneuvers
- Designed assembly mechanisms for self-folding of mesoscale structures

*Graduate researcher* to Robert J. Wood 2011-2015

- Designed and simulated an active heading control mechanism inspired by the turning behavior of fruit flies
- Built, characterized and integrated the control mechanism with existing power transmission using PC-MEMS techniques, enabling the first demonstration of heading control experiments on an ISFW robot
- Designed, simulated and fabricated aerodynamic dampers onto a ISFW robot to enable passive upright stability
- Presented results at 3 international conferences

**Stanford University** 2010

*Graduate research assistant* to Mark R. Cutkosky and Alexis Lussier Desbiens

- Initiated research into jump gliding as a way for small unmanned arial vehicles to take-off when there is no runway
- Built and tested carbon fiber based spring mechanisms and quick release mechanisms for jumping mechanism

**Data Storage Institute, Agency for Science Technology and Research, Singapore** 2009

*Research intern* to Vikas Reddy

- Self-taught embedded programming using the Arduino platform to enable control of a quadcopter
- Designed and built a multi-mode quadcopter that could roll on the ground and fly

**Cornell University** 2007-2008

*Undergraduate research assistant* to Hod Lipson

- Modularized the drive mechanism of an existing passively stable flapping vehicle to enable rapid iteration of prototype designs.

## Work Experience

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**Vibrant Composites** 2013-2015

*Design engineer*

- Constructed micro-pumps using PC-MEMS techniques
- Designed laminate based two degree-of-freedom spherical mechanisms for orientation purposes

## Patents

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Zippering actuator fluid motivation. Pratheev Sreetharan, **Zhi Ern Teoh**, Andrew Baisch and Alina Visco. US 20160201662

Synchronized folding of platonic polyhedra using an assembly linkage having a rotating link. **Zhi Ern Teoh**, Robert J. Wood, and Chuck Hoberman. Patent pending.

Pop-up laminate structure including miniature optical components. Michael Karpelson, **Zhi Ern Teoh**, and Robert J Wood. Patent pending. Filed 16 September 2015.

## Leadership Experience

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- Harvard University** 2011  
*Teaching Fellow*
- Assisted in teaching an undergraduate course in Computer-Aided Machine Design
  - Taught students how to use basic fabrication tools as well as CNC machining
  - Led weekly laboratory and discussion groups for 23 students and supervised students in their final projects
- Stanford University** 2010  
*Teaching Fellow*
- Assisted in teaching a graduate course in Analysis of Structures
  - Led discussion groups for 30 students
- Singapore Armed Forces, 42nd Singapore Armored Regiment** 2003-2005  
*3rd Sergeant, Reconnaissance*
- Trained incoming recruits how to conduct reconnaissance in urban and jungle environments
  - Led a group of 4 personnel in reconnaissance missions

## Software

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- CAD software- Solidworks, Draftsight, Qcad, GibbsCAM, MasterCAM, PopUpCAD (tool path generation for laminate devices)
- Miscellaneous software - Matlab, MotionGenesis (multi-body symbolic force, motion, and code generation tool), Python, LATEX, Adobe Illustrator, Excel, Word, Keynote

## Publications and Presentations

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- [1] Floris Van Breugel, **Zhi Ern Teoh**, and Hod Lipson. A passively stable hovering flapping micro-air vehicle. In *Flying insects and robots*, pages 171–184. Springer, 2010. Book chapter.
- [2] **Zhi Ern Teoh**, Sawyer B Fuller, Pakpong Chirarattananon, NO Prez-Arancibia, Jack D Greenberg, and Robert J Wood. A hovering flapping-wing microrobot with altitude control and passive upright stability. In *Intelligent Robots and Systems (IROS), 2012 IEEE/RSJ International Conference on*, pages 3209–3216. IEEE, 2012. Article and presentation.
- [3] **Zhi Ern Teoh**, Sawyer B Fuller, Andrew Baisch, and Robert J Wood. Pop-up book mems assembly of complex microrobots. In *Robotics and Automation (ICRA), 2013 IEEE International Conference on*. IEEE, 2013. Workshop presentation.
- [4] **Zhi Ern Teoh** and Robert J Wood. A flapping-wing microrobot with a differential angle-of-attack mechanism. In *Robotics and Automation (ICRA), 2013 IEEE International Conference on*, pages 1381–1388. IEEE, 2013. Article and presentation.
- [5] **Zhi Ern Teoh** and Robert J Wood. A bioinspired approach to torque control in an insect-sized flapping-wing robot. In *Biomedical Robotics and Biomechatronics 2014 5th IEEE RAS & EMBS International Conference on*, pages 911–917. IEEE, 2014. Article and presentation.
- [6] Sawyer B Fuller, **Zhi Ern Teoh** (authors contributed equally), Pakpong Chirarattananon, NO Prez-Arancibia, Jack D Greenberg, and Robert J Wood. Stabilizing air dampers for insect-scale hovering aerial robots: An analysis of nonlinear dynamics based on flight tests gives design guidelines. Under review, submitted 2015.