

## *Senior Research Engineer in Siemens Digital Industries Software in Control Systems, ADAS and Autonomous Vehicle*

### Overview

Research engineer working in autonomous vehicle industry sector. Strong background in control system area with a proven track record from theory, designing, to implementation. Active in research and development activities such as collaborations, publishing, reviewing, supervising PhD/Master students. Experienced project management and communication skills in multicultural and dynamic environments.

- Highlights
- Siemens DF PL Invention of the Year Award.
  - Finalist of the AutoSens Award 2019 in Most Influential Research.
  - Published frequently to top journals and conferences: Automatica, IEEE Trans. on Automatic Control, ACC, CDC, IFAC World Congress....
  - Project manager and execution of EU and Belgian R&D projects.
  - Collaboration with experts in control field (from KULeuven, MIT, EPFL, UTokyo...).
  - Technical Committee and Conference Editorial Board of IEEE Control System Society.
  - EU Marie Curie Fellowship.

### Education

- Oct. 2016 **Ph.D. in Mechanical Engineering**, KULeuven, Leuven, Belgium.  
Advisors: Prof. Jan Swevers, Prof. Goele Pipeleers
- Feb. 2012 **M.S. of Research in Mechatronics**, GIST, Gwangju, South Korea.  
Advisor: Prof. Hyo-Sung Ahn
- Jun. 2009 **B.S. in Electrical Engineering**, HUST, Hanoi, Vietnam.

### (Recent) Updates

- Jan. 2019 **2018 Siemens DF PL Invention of the Year Award.**  
This is a yearly competition to recognize and award the most significant invention during the fiscal year from the Siemens DF PL business unit worldwide. The award includes cash prize and company announcement
- Sept. 2019 **Finalist of the AutoSens Award 2019 in Most Influential Research.**  
<https://auto-sens.com/awards-2019-finalists-revealed/>
- June 2019 **PhD Jury Committee Member of Armin M. Steinhauser**, MECO Research Group, Dept. of Mechanical Engineering, KULeuven.
- May 2019 **Presented in JSAE Annual Congress**, Yokohama, Japan.  
Presented the developments of autonomous driving safety-critical control and scenario generation  
<https://www.jsae.or.jp/2019haru/english/index.html>
- May 2019 **Invited Seminar in Hori-Fujimoto Lab, University of Tokyo**, Japan.  
<https://sites.google.com/edu.k.u-tokyo.ac.jp/hflab/home>
- Sept. 2018 **Invited Talk in AutoSens Conference**, Brussels, Belgium.  
AutoSens is an autonomous vehicle event, participants are the world's leading minds in ADAS and autonomous vehicles: <https://auto-sens.com/speakers-brussels/>
- May 2018 **Invited Seminar in Automatic Control Laboratory, EPFL**, Lausanne, Switzerland.  
<https://memento.epfl.ch/event/simulation-based-testing-and-validation-framework-/>

- June 2018 **Invited Talk in REM2018**, Delft, Netherlands.  
The 19th International Conference on Research and Education in Mechatronics: <http://www.rem2018.nl/>
- May 2018 **Presented in JSAE Annual Congress**, Yokohama, Japan.  
Presented the Siemens PLM developments on autonomous valet parking planning and control  
<http://www.jsae.or.jp/2018haru/english/>
- April 2018 **Presented in Transport Research Arena**, Vienna, Austria.  
Presented the Siemens PLM co-simulation testing and validation framework for ADAS developments  
<https://www.traconference.eu/>

## Experience

- 2016–Present **Senior Research Engineer**, Siemens.  
Working on multiple European and Belgian research and development projects, with focus on control and ADAS and autonomous vehicle. Setup collaborations with academic institutes.
- Autonomous valet parking, highway pilot, green wave technology, intersection crossing
  - Optimal and model predictive control (MPC) developments with real-time implementations
  - Collision avoidance algorithm developments
  - Machine learning algorithms: deep learning, Gaussian process, imitation learning
  - Driving style classification
  - Mixed virtual-real testing for ADAS development process
  - Driving scenario generation
  - HEV optimal control
  - Publishing journals, conferences, patents and white papers
- 2016–Present **Project Management and Supervisor**, Siemens.
- Manage control and ADAS/AV projects: coordination with internal and external partners, proposal writing
  - Supervise PhD, researcher, Master, and intern students in the R&D team
- 2012–2015 **EU Marie Curie ITN Training Programme**, EU FP7 IMESCON Project.
- EU Marie Curie scholarship to do PhD and research/training programs in EU
  - Model identification and control design for the amplified piezo actuator, Cedrat Technologies (France).
  - Visited Cedrat Technologies company for doing model identification.
  - Various trainings within the EU FP7 project scope.
- 2012–2016 **Advance Control Design for Mechatronic Systems**, KU Leuven, Belgium.
- Control theory: linear and nonlinear control, robust control, optimal control...
  - Design techniques: PID, loop-shaping, model-based control, H-infinity control, MIMO control, feedforward control, model predictive control (MPC)...
  - Optimization tools: convex optimization, LMI, optimization softwares
  - Experimentally validated on a lab-scale overhead crane and XY wafer stage setups.
- 2012–2016 **Iterative Learning Control (ILC)**, KU Leuven, Belgium.
- Main PhD research topic
  - Proposed a novel robust norm-optimal iterative learning control in time domain
    - An optimization problem accounting for system uncertainty
    - Guarantee global optimal solution, and can be solved efficiently
  - Proposed and designed a multi-objective ILC problem in frequency domain
    - Robustness, convergence speed, tracking error, and input energy objectives
    - Efficient computation
  - Developed multivariable ILC analysis and design
- 2010–2012 **Research Assistant**, GIST, South Korea.
- Did research in the Distributed Control and Autonomous Systems Lab. (GIST)
  - Developed multiple points tracking iterative learning control

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## Professional Services

- IEEE CSS Conference Editorial Board: American Control Conference 2020 and 2021, IEEE Conference on Decision and Control 2020
- Technical Committee On Automotive Control and Smart Cities in IEEE Control System Society
- Reviews Transport Research Arena, IEEE Transaction on Automatic Control, IEEE Transaction on Control System Technology, International Journal of Robust and Nonlinear Control, Control & System Letters, Mechatronics, IEEE Conference on Decision and Control, American Control Conference, IFAC conferences
- Memberships IEEE Control System Society, IEEE Robotics & Automation

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## Teaching and Supervision

- 2016- Supervising various PhD and Master thesis students from KULeuven, EPFL, Linköping Univ., PoliTo, UTokyo, Grenoble...
- 2012-2015 **Master course in KULeuven:** Control Theory Exercise Sessions
- 2012-2015 **Master course in KULeuven:** System Theory Exercise Sessions

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## Skills

- ADAS Trajectory planning, tracking control, machine learning, vehicle dynamic simulation, environment simulation, test generation and automation, verification and validation of control algorithms
- Control System identification, analysis, control implementation, and validation
- Programming MATLAB, Simulink, Python, ROS, dSPACE, LabVIEW
- PreScan, Vires VTD, Imagine Amesim.Lab, Imagine Embedded Software Designer, L<sup>A</sup>T<sub>E</sub>X, HTML

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## Awards

- 2018 Siemens DF PL Invention of the Year
- 2012-2015 Marie Curie Early Stage Researcher Fellowship
- 2011 Best Presentation in Session Award, 2011 American Control Conference
- 2010-2012 GIST Scholarship for Master student
- 2009 International Internship Scholarship in South Korea

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## Selected Publications

1. **Son, T.D.**, Awatsu L., Hubrechts J., Bhawe A., and Van der Auwerier H., “A simulation-based verification and testing framework for ADAS development”, *Transport Research Arena*, Vienna, 2018
2. Diwale S., **Son, T.D.**, Jones C., “Manifold learning and optimal control for obstacle avoidance in autonomous driving”, *submitted*, 2018
3. **Son, T.D.**, Pipeleers, G., and Swevers, J., “Multi-objective iterative learning control using convex optimization”, *European Journal of Control*, Jan. 2017
4. **Son, T.D.**, Pipeleers, G., and Swevers, J., “Robust monotonic convergent iterative learning control”, *IEEE Transactions on Automatic Control*, Issue 99, Jul. 2015
5. **Son, T.D.**, Ahn, H.S., and Moore, K., “Iterative learning control in optimal tracking problems with specified data points”, *Automatica*, Issue 5, May 2013
6. **Son, T.D.**, Quan N., “Safety-critical control for non-affine nonlinear systems with application on autonomous vehicle”, *58th IEEE Conference on Decision and Control*, Nice, Dec. 2019
7. **Son, T.D.**, Lanh, N., and Van der Auwerier H., “Learning control applications for autonomous driving in extreme maneuver scenarios”, *submitted*

8. **Son, T.D.**, Bhawe A., and Van der Auwerier H., "Simulation-based testing framework for autonomous driving development", *IEEE 2019 International Conference on Mechatronics*, Ilmenau, Germany, Mar. 2019
9. Steinhauser, A., **Son, T.D.**, Hostens, E., and Swevers, J., "ROFALT: An Optimization-based Learning Control Tool for Nonlinear Systems", *The 15th International Workshop on Advanced Motion Control*, Tokyo, Mar. 2018
10. **Son, T.D.**, A., Pipeleers, G., and Swevers, J., and Van der Auwerier H., "A Generalized Frequency Domain Learning Control Design with Experimental Validation", *The 43rd Annual Conference of the IEEE Industrial Electronics Society*, Beijing, Nov. 2017
11. **Son, T.D.**, Steinhauser, A., Pipeleers, G., and Swevers, J., "Robust performance iterative learning control : Analysis, synthesis and experimental validation", *The European Control Conference (ECC16)*, Denmark, Jul. 2016
12. **Son, T.D.**, Pipeleers, G., and Swevers, J., "Robust analysis and synthesis with unstructured model uncertainty in lifted system iterative learning control", *2015 American Control Conference (ACC15)*, Chicago, USA, Jun. 2015
13. **Son, T.D.**, Pipeleers, G., and Swevers, J., "Experimental validation of robust iterative learning control on an overhead crane test setup", *The 19th World Congress IFAC 2014*, Cape Town, South Africa, Aug. 2014
14. **Son, T.D.**, Pipeleers, G., and Swevers, J., "Robust optimal iterative learning control with model uncertainty", *The 52nd IEEE Conference on Decision and Control (CDC13)*, Florence, Italy, Dec. 2013
15. **Son, T.D.**, Pipeleers, G., and Swevers, J., "Optimal iterative learning control design with trial-varying initial conditions", *The European Control Conference (ECC13)*, Zurich, Switzerland, Jul. 2013
16. **Son, T.D.**, Ahn, H.S., "Optimal iterative learning control with uncertain reference points", *The 2012 IEEE Multi-Conference on Systems and Control*, Dubrovnik, Croatia, Oct. 2012
17. **Son, T.D.**, Ahn, H.S., "Iterative learning control for optimal multiple-point tracking", *The 50th IEEE Conference on Decision and Control and European Control Conference (CDC-ECC 2011)*, Orlando, USA, Dec. 2011
18. **Son, T.D.**, Ahn, H.S., "An interpolation method of multiple terminal iterative learning control", *The 2011 IEEE Multi-Conference on Systems and Control (MSC 2011)*, Denver, CO 80202, USA, Sept.. 2011
19. **Son, T.D.**, Ahn, H.S., "Terminal iterative learning control with multiple intermediate pass points", *The 2011 American Control Conference (ACC11)*, San Francisco, USA (**The Best Presentation in Session Award**), Jun. 2011