

*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.

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
- 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>
- Mar. 2019 **Co-organize an invited Automotive Control Session in CDC2019**, Nice, France.
- 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/>

Professional Services

- IEEE CSS Technical Committee On Automotive Control and Smart Cities in IEEE Control System Society
Co-organizing member of the Invited Automotive Control Session in CDC2019
- Reviews Transport Research Arena (2018)
IEEE Transaction on Automatic Control (2014, 2015)
IEEE Transaction on Control System Technology (2017)
International Journal of Robust and Nonlinear Control (2018)
Control & System Letters (2015)
Mechatronics (2015, 2016, 2017, 2019)
International Journal of Control (2017)
IET Control Theory & Applications (2015, 2016)
IEEE Conference on Decision and Control (2013)
American Control Conference (2019)
IFAC Adaptation and Learning in Control and Signal Processing (2013)
- Memberships IEEE Control System Society, IEEE Robotics & Automation

Teaching and Supervision

- 2016- Supervising PhD in EU projects and Master thesis students
- 2012-2015 **Master course in KULeuven:** Control Theory Exercise Sessions
- 2012-2015 **Master course in KULeuven:** System Theory Exercise Sessions

Experience

- 2016–Present **Senior Research Engineer**, Siemens PLM, Belgium.
Working on different European and Belgian research and development projects, with focus on control and ADAS and autonomous vehicle domains. Strong collaboration with control systems groups from academic institutes such as KULeuven (Belgium), EPFL (Switzerland), and Grenoble INP (France).
- Applications: autonomous valet parking, highway pilot, green wave technology, intersection crossing
 - Optimal and model predictive control (MPC) developments with real-time implementations
 - Collision avoidance (pedestrians, other vehicles) algorithm developments
 - Virtual testing and validation of ADAS co-simulation system development framework
 - Optimize control performance of autonomous vehicles through data-driven learning
 - HEV vehicle model control to optimize fuel consumption
 - Publishing journal, conference, patents and white papers
- 2016–Present **Project Management and Supervisor**, Siemens PLM, Belgium.
- Manage control and ADAS/AV projects: project administration and proposal writing, collaborating with partners
 - Supervise PhD, 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 feedback control design for the amplified piezo actuator, Cedrat Technologies (France).
 - Visited Cedrat Technologies company for doing model identification.
 - Attended various trainings, meetings within the EU FP7 project.
- 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 and straightforward computation of trade-off curves between objective indices.Help control engineers to choose their desired controller w.r.t. these compromises
- 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

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^AT_EX, HTML

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

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”, *Automatica (submitted)*, 2018
2. **Son, T.D.**, Pipeleers, G., and Swevers, J., “Multi-objective iterative learning control using convex optimization”, *European Journal of Control*, Jan. 2017
3. **Son, T.D.**, Pipeleers, G., and Swevers, J., “Robust monotonic convergent iterative learning control”, *IEEE Transactions on Automatic Control*, Issue 99, Jul. 2015
4. **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
5. **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*, submitted, Nice, Dec. 2019
6. **Son, T.D.**, Lanh, N., and Van der Auwerier H., “Learning control applications for autonomous driving in extreme maneuver scenarios”, *58th IEEE Conference on Decision and Control*, submitted, Nice, Dec. 2019
7. **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

8. 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
9. **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
10. **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
11. **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
12. **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
13. **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
14. **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
15. **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
16. **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
17. **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
18. **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