4th IFAC Conference on Modelling and Control in Agriculture, Horticulture and Post Harvest Industry 2013

Espoo, Finland
28 – 30 August 2013

Editors:

A. Visala

Content List of 4th IFAC Conference on Modelling and Control in Agriculture, Horticulture and Post Harvest Industry

Technical Program for Wednesday August 28, 2013

WeP1P	TUAS Hall AS1
Plenary I (Plenary Session)	
Chair: Noguchi, Noboru	Hokkaido Univ.

09:15-10:00	WeP1P.1

Advanced Control of Combine Harvesters, pp. 1-5.

De Baerdemaeker, Josse	Katholieke Univ. Leuven
Saeys, Wouter	Katholieke Univ. Leuven

We1A	TUAS Hall AS1
Post-Harvest (Regular Session)	
Chair: Shimizu, Hiroshi	Kyoto Univ.

10:20-10:40	We1A.1

Smooth Adaptive Robust Temperature Control of a Seed Drying System, pp. 6-11.

Oliveira, Josenalde Barbosa	Agricultural School of Jundiaí

10:40-11:00	We1A.2

Grain Dryer Temperature Optimisation with Simulation and a Test Dryer, pp. 12-17.

Tiusanen, Johannes	Univ. of Helsinki
Jokiniemi, Heikki Tapani	Univ. of Helsinki
Hautala, Mikko	Univ. of Helsinki

11:00-11:20	We1A.3

Continuous Sliding Mode Temperature Tracking of a Solid State Fermentation Reactor for Substrate Production, pp. 18-23.

Sanchez, Arturo	Centro de Investigacion y Estudios Avanzados
Loukianov, Alexander G.	CINVESTAV IPN GDL
Aroche, Oscar	Centro de Investigación y Estudios Avanzados del IPN, Unidad Gua

11:20-11:40	We1A.4

Optical Sensing of Internal Hollow Heart Related Defects of Potatoes, pp. 24-28.

Alander, Jarmo	Univ. of Vaasa
Bochko, Vladimir	Univ. of Vaasa
Martinkauppi, J. Birgitta	Univ. of Vaasa
Välisuo, Petri	Univ. of Vaasa
Söderbacka, Christian	Univ. of Vaasa

We1B	TUAS Hall TU1
Robotics: Sensors (Regular Session)	
Chair: Rovira-Más, Francisco	Pol. Univ. of Valencia

10:20-10:40	We1B.1

Turning Performance of Combine Robot by Various Compasses, pp. 29-34.

Iida, Michihisa	Kyoto Univ.
Kurita, Hiroki	Kyoto Univ.
Cho, Won-Jae	Kyoto Univ.
Mochizuki, Yuki	Kyoto Univ.
Yamamoto, Ryosuke	Kyoto Univ.
Suguri, Masahiko	Kyoto Univ.
Masuda, Ryohei	Kyoto Univ.

10:40-11:00	We1B.2

Collision Avoidance Method with Nonlinear Model Predictive Trajectory Control, pp. 35-40.

Backman, Juha	Aalto Univ. School of Electrical Engineering
Oksanen, Timo	Aalto Univ.
Visala, Arto	Aalto Univ. ELEC School

11:00-11:20	We1B.3

A Global Positioning System Guided Automated Rice Transplanter, pp. 41-46.

Nagasaka, Yoshisada	National Agriculture and Food Res. Organization

Tamaki, Katsuhiko	National Agriculture Res. Organization
Nishiwaki, Kentaro	National Agriculture and Food Res. Organization
Saito, Masahiro	National Agriculture and Food Res. Organization
Kikuchi, Yutaka	National Agriculture and Food Res. Organization
Motobayashi, Kota	National Agriculture and Food Res. Organization

| 11:20-11:40 | We1B.4 |

Image Processing for Ridge/Furrow Discrimination for Autonomous Agricultural Vehicles Navigation, pp. 47-51.

Takagaki, Akane	Kyoto Univ.
Masuda, Ryohei	Kyoto Univ.
Iida, Michihisa	Kyoto Univ.
Suguri, Masahiko	Kyoto Univ.

| 11:40-12:00 | We1B.5 |

Implementation and Comparison of Attitude Estimation Methods for Agricultural Robotics, pp. 52-57.

| Utstumo, Trygve | Norwegian Univ. of Science and Tech. |
| Gravdahl, Jan Tommy | Norwegian Univ. of Science & Tech. |

| **We2A** | TUAS Hall AS1 |

Instrumentation and Machine Perception (Regular Session)

| Chair: Kondo, Naoshi | Kyoto Univ. |

| 13:00-13:20 | We2A.1 |

Advances in Automatic Detection of Tulip Breaking Virus (TBV) Using Machine Vision, pp. 58-63.

Polder, Gerrit	Wageningen Univ.
van der Heijden, Gerie W.A.M.	Wageningen Univ.
van Doorn, Joop	Wageningen Univ.
Baltissen, Ton A.H.M.C.	Wageningen Univ.

| 13:20-13:40 | We2A.2 |

Automatic Detection of Abnormally Soft Tomatoes, pp. 64-69.

Martinkauppi, J. Birgitta	Univ. of Vaasa
Bochko, Vladimir	Univ. of Vaasa
Välisuo, Petri	Univ. of Vaasa
Kulmanen, Ari	Ikaalisten Luomu
Rintala, Tommi	Univ. of Vaasa
Söderbacka, Christian	Univ. of Vaasa
Alander, Jarmo	Univ. of Vaasa

| 13:40-14:00 | We2A.3 |

Detection of Food Hazards Using Fluorescence Fingerprint, pp. 70-74.

Sugiyama, Junichi	National Food Res. Inst.
Fujita, Kaori	National Food Res. Inst.
Yoshimura, Masatoshi	National Food Res. Inst.
Tsuta, Mizuki	National Food Res. Inst.
Shibata, Mario	National Food Res. Inst.
Kokawa, Mito	National Food Res. Inst.

| 14:00-14:20 | We2A.4 |

A Method to Detect the Occurrence of Rice Plant Lodging Using Wavelet Transform, pp. 75-80.

Masuda, Ryohei	Kyoto Univ.
Fujimoto, Shinji	Kyoto Univ.
Iida, Michihisa	Kyoto Univ.
Suguri, Masahiko	Kyoto Univ.

| 14:20-14:40 | We2A.5 |

Image Analysis of Trout Cutlets, pp. 81-84.

Bochko, Vladimir	Univ. of Vaasa
Airaksinen, Susanna	Finnish Game and Fisheries Res. Inst.
Ruohonen, Mika	Univ. of Vaasa
Alander, Jarmo	Univ. of Vaasa

| **We2B** | TUAS Hall TU1 |

Robotics: Navigation (Regular Session)

Chair: Iida, Michihisa	Kyoto Univ.

13:00-13:20	We2B.1

Systematic Model Based Path Tracking Control of Actively Steered Implements in Simulation and Experiment, pp. 85-90.

Werner, Roland	Univ. of Kaiserslautern
Kormann, Georg Aloys Ludwig	John Deere GmbH & Co. KG
Mueller, Steffen	Tech. Univ. of Kaiserslautern

13:20-13:40	We2B.2

A Row Crop Following Behavior Based on Fuzzy Primitive Behaviors for Navigation System of Agricultural Robots, pp. 91-96.

Sousa, Rafael Vieira de	Univ. of São Paulo
Tabile, Rubens Andre	Univ. of São Paulo
Inamasu, Ricardo Yassushi	Brazilian Agricultural Inst. Res. Corp.
Porto, Arthur Jose Viera	USP - Engineering School of São Carlos

13:40-14:00	We2B.3

Complete Field Coverage As a Multi-Vehicle Routing Problem, pp. 97-102.

Burger, Mernout	Delft Univ. of Tech.
Huiskamp, Marco	ASML
Keviczky, Tamas	Delft Univ. of Tech.

14:00-14:20	We2B.4

Development of a Laser Scanner-Based Navigation System for a Combine Harvester, pp. 103-108.

Choi, Jongmin	Hokkaido Univ.
Yin, Xiang	Hokkaido Univ.
Noguchi, Noboru	Hokkaido Univ.

14:20-14:40	We2B.5

Development of a Target Following System for a Field Robot, pp. 109-114.

Yin, Xiang	Hokkaido Univ.
Noguchi, Noboru	Hokkaido Univ.

We3A	TUAS Hall AS1
Information Technologies and Networks (Regular Session)	
Chair: Visala, Arto	Aalto Univ. ELEC School

15:00-15:20	We3A.1

Standardized Control and Communication Data Network for a Small Range Agricultural Machinery, pp. 115-120.

Motobayashi, Kota	National Agriculture and Food Res. Organization
Nishiwaki, Kentaro	National Agriculture and Food Res. Organization
Hamada, Yasuyuki	National Agriculture and Food Res. Organization
Okuno, Rintaro	National Agriculture and Food Res. Organization
Teramoto, Ikuhiro	National Agriculture and Food Res. Organization
Tamaki, Katsuhiko	National Agriculture Res. Organization
Nagasaka, Yoshisada	National Agriculture and Food Res. Organization
Kikuchi, Yutaka	National Agriculture and Food Res. Organization
Saito, Masahiro	National Agriculture and Food Res. Organization

15:20-15:40	We3A.2

Development of an Object-Oriented Version of TOMGRO for a Web-Based Decision Support System, pp. 121-126.

Lousky, Marc	Tech.
Linker, Raphael	Tech.
Teitel, Meir	Agricultural Res. Organization

15:40-16:00	We3A.3

DASH7 Mode 2: A Promising Perspective for Wireless Agriculture, pp. 127-132.

Piromalis, Dimitrios	Tech. EDUCATIONAL Inst. OF PIRAEUS
Arvanitis, Kostas	Agricultural Univ. of Athens
Sigrimis, Nick	Ag Univ. of Athens

16:00-16:20	We3A.4

Ant Colony Optimization for Scheduling of Agricultural Contracting Work, pp. 133-137.

Alaiso, Sami Oskari	Aalto Univ.
Backman, Juha	Aalto Univ. School of Electrical Engineering
Visala, Arto	Aalto Univ. ELEC School

16:20-16:40	We3A.5

Remote Monitoring of Agricultural Robot Using Web Application, pp. 138-142.

Ishibashi, Maya	Kyoto Univ.
Iida, Michihisa	Kyoto Univ.
Suguri, Masahiko	Kyoto Univ.
Masuda, Ryohei	Kyoto Univ.

We3B	TUAS Hall TU1
Robotics III (Regular Session)	
Chair: Noguchi, Noboru	Hokkaido Univ.

15:00-15:20	We3B.1

A Robot System for Paddy Field Farming in Japan, pp. 143-147.

Tamaki, Katsuhiko	National Agriculture Res. Organization
Nagasaka, Yoshisada	National Agriculture and Food Res. Organization
Nishiwaki, Kentaro	National Agriculture and Food Res. Organization
Saito, Masahiro	National Agriculture and Food Res. Organization
Kikuchi, Yutaka	National Agriculture and Food Res. Organization
Motobayashi, Kota	National Agriculture and Food Res. Organization

15:20-15:40	We3B.2

Development of Robot Combine Harvester for Beans Using CAN Bus Network, pp. 148-153.

Saito, Masahiro	National Agriculture and Food Res. Organization
Tamaki, Katsuhiko	National Agriculture Res. Organization
Nagasaka, Yoshisada	National Agriculture and Food Res. Organization
Nishiwaki, Kentaro	National Agriculture and Food Res. Organization
Motobayashi, Kota	National Agriculture and Food Res. Organization

15:40-16:00	We3B.3

Development of Path Planning Algorithm for an Autonomous Mower Tractor, pp. 154-158.

Song, Mingzhang	Chungnam National Univ.
Kang, Sin-Woo	Chungnam National Univ.
Chung, Sun-Ok	Chungnam National Univ.
Kim, Ki-Dae	Chungnam National Univ.
Chae, Young-Suk	Chungnam National Univ.
Lee, Dae-Hyun	LS Mtron Ltd.
Kim, Yong-Joo	LS Mtron Ltd.
Yu, Seung-Hwa	Chonnam National Univ.
Lee, Kyeong-Hwan	Chonnam National Univ.

16:00-16:20	We3B.4

Control of Four Wheel Steering Using Independent Actuators, pp. 159-163.

Oksanen, Timo	Aalto Univ.
Linkolehto, Raimo	MTT

16:20-16:40	We3B.5

ISO 11783 Compliant Forest Crane As a Platform for Automatic Control, pp. 164-169.

Kalmari, Jouko	Aalto Univ.
Pihlajamäki, Tuomas	Tampere Univ. of Tech.
Hyyti, Heikki Sakari	Aalto Univ.
Luomaranta, Markku	Tampere Univ. of Tech.
Visala, Arto	Aalto Univ. ELEC School

Technical Program for Thursday August 29, 2013

ThP2P	TUAS Hall AS1
Plenary II (Plenary Session)	
Chair: De Baerdemaeker, Josse	Katholieke Univ. Leuven

08:30-09:15	ThP2P.1

Robotics in Protected Cultivation, pp. 170-177.

Van Henten, Eldert Jan	Wageningen Univ.
Bac, Wouter	Wageningen Univ.
Hemming, Jochen	Wageningen Univ.
Edan, Yael	Ben-Gurion Univ.

ThP3P	TUAS Hall AS1
Plenary III (Plenary Session)	
Chair: Visala, Arto	Aalto Univ. ELEC School

09:15-10:00	ThP3P.2

Biofuel from Waste Agricultural Product and Lignocellulosic Biomass, pp. 178-186.

Dewan, Alim	Texas Tech. Univ.
Raftery, Jonathan P.	Texas A&M Univ.
Li, Zheng	Texas Tech. Univ.
Karim, M. Nazmul	Texas A & M Univ.

Th1A	TUAS Hall AS1
Modelling and Estimation (Regular Session)	
Chair: Oksanen, Timo	Aalto Univ.

10:30-10:50	Th1A.1

Energy Balance Model for Prediction of Plant Shoot-Tip Temperature, pp. 187-190.

Shimizu, Hiroshi	Kyoto Univ.

10:50-11:10	Th1A.2

Multi-Machine Coordination: Scheduling Operations Based on Readiness Criteria and Using a Modified Tabu Search Algorithm, pp. 191-195.

Edwards, Gareth Thomas Charles	Aarhus Univ.
Bochtis, Dionysis	Aarhus Univ.
Sørensen, Claus Aage Grøn	Aarhus Univ.

11:10-11:30	Th1A.3

Spatial and Temporal Yield Variation in Three Different Clay Soil Fields, pp. 196-201.

Hakojärvi, Mikko	Univ. of Helsinki
Hautala, Mikko	Univ. of Helsinki
Ristolainen, Antti	MTT Agrifood Res. Finland
Alakukku, Laura	Univ. of Helsinki

11:30-11:50	Th1A.4

Estimating Operational Efficiency of Field Work Based on Field Shape, pp. 202-206.

Oksanen, Timo	Aalto Univ.

Th1B	TUAS Hall TU1
Systems and Safety (Regular Session)	
Chair: Alander, Jarmo	Univ. of Vaasa

10:30-10:50	Th1B.1

Vulnerability of GPS to Provide Vehicle States in Real Time, pp. 207-212.

Rovira-Más, Francisco	Pol. Univ. of Valencia

10:50-11:10	Th1B.2

Automatic Recognition of Operation Modes of Combines and Transport Units Based on GNSS Trajectories, pp. 213-218.

Jensen, Martin Andreas Falk	Aarhus Univ.
Bochtis, Dionysis	Aarhus Univ.

11:10-11:30	Th1B.3

Potential of Hyperspectral Imaging for Constructing a Year-Invariant Model to Estimate the Nitrogen Content of Rice Plants at the Panicle

Initiation Stage, pp. 219-224.

Onoyama, Hiroyuki	Kyoto Univ.
Ryu, Chanseok	Gyeongsang National Univ.
Suguri, Masahiko	Kyoto Univ.
Iida, Michihisa	Kyoto Univ.

Th2A	TUAS Hall AS1
Control and Automation in Horticulture (Regular Session)	
Chair: Van Henten, Eldert Jan	Wageningen Univ.

13:00-13:20	Th2A.1

Co-State Variables As Strategic Set-Point Generators for Greenhouse Environmental Control, pp. 225-230.

Seginer, Ido	Tech. - Israel Inst. of Tech.

13:20-13:40	Th2A.2

Development of a Movable Bench System for Strawberries and the Potential for Plant Growth Measurement, pp. 231-234.

Hayashi, Shigehiko	Bio-oriented Tech. Res. Advancement Inst.
Yamamoto, Satoshi	Bio-oriented Tech. Res. Advancement Inst. NARO
Saito, Sadafumi	Bio-oriented Tech. Res. Advancement Inst.
Ochiai, Yoshiji	Bio-oriented Tech. Res. Advancement Inst.
Hiroyuki, Inazumi	SHIBUYA SEIKI co. Ltd.
Tsubota, Shogo	Bio-oriented Tech. Res. Advancement Inst.

13:40-14:00	Th2A.3

Performance of an Infrared Heating System in a Production Greenhouse, pp. 235-240.

Kavga, Angeliki	Tech. Educational Inst. of Messologi, Greece
Karanastasi, Eirini	Tech. Educational Inst. of Messolonghi
Konstas, Ioannis	Geoponiki S.A., Lavrion Anenue, Koropi Attica, Greece
Panidis, Thrassos	Department of Mechanical Engineering & Aeronautics, Univ. o

14:00-14:20	Th2A.4

Location and Number of Sampling for Optical Reflectance Measurement of Chinese Cabbage and Kale Leaves, pp. 241-246.

Ngo, Viet Duc	Chungnam National Univ.
Kang, Sin-Woo	Chungnam National Univ.
Ryu, Dong-Ki	Chungnam National Univ.
Chung, Sun-Ok	Chungnam National Univ.
Park, Sang-Un	Chungnam National Univ.
Kim, Sun-Ju	Chungnam National Univ.
Park, Jong-Tae	Chungnam National Univ.

14:20-14:40	Th2A.5

Task and Motion Planning for Apple-Harvesting Robot, pp. 247-252.

Nguyen, Tien Thanh	MeBioS - BioSyst - KU Leuven
Kayacan, Erdal	KULeuven
De Baerdemaeker, Josse	Katholieke Univ. Leuven
Saeys, Wouter	Katholieke Univ. Leuven

Th2B	TUAS Hall TU1
Mechatronics (Regular Session)	
Chair: De Baerdemaeker, Josse	Katholieke Univ. Leuven

13:00-13:20	Th2B.1

Front Wheel Skidding Compensation System in Snow Ploughing, pp. 253-258.

Backman, Juha	Aalto Univ. School of Electrical Engineering
Oksanen, Timo	Aalto Univ.
Visala, Arto	Aalto Univ. ELEC School

13:20-13:40	Th2B.2

Design Considerations for ISOBUS Class 3 Machinery System's Human-Machine Interaction, pp. 259-263.

Ronkainen, Ari	MTT Agrifood Res. Finland

13:40-14:00	Th2B.3

Development of Tractor Automatic Controlled Boom Sprayer Using CAN-BUS, pp. 264-269.

Yuki, Shoichi	YAMABIKO Corp.
Yasuda, Hideaki	YAMABIKO Corp.

| Matsubayashi, Tatsuhiko | YAMABIKO Corp. |
| Ishizuka, Hironobu | YAMABIKO Corp. |

14:00-14:20	Th2B.4

Cartesian Control of an Advanced Tractors Rear Hitch - Geometric Solution, pp. 270-275.

Matikainen, Ville Valtteri	Aalto Univ. School of Electrical Engineering
Backman, Juha	Aalto Univ. School of Electrical Engineering
Visala, Arto	Aalto Univ. ELEC School

14:20-14:40	Th2B.5

Application of Systematic Methods in the Electromechanical Design of an Agricultural Mobile Robot, pp. 276-281.

Tabile, Rubens Andre	Univ. of São Paulo
Godoy, Eduardo Paciencia	UNESP - São Paulo State Univ.
Tangerino, Giovana Tripoloni	School of Engineering of Sao Carlos - Univ. of São Paulo -
Porto, Arthur Jose Viera	USP - Engineering School of São Carlos
Inamasu, Ricardo Yassushi	Brazilian Agricultural Inst. Res. Corp.
Sousa, Rafael Vieira de	Univ. of São Paulo

Th3A	TUAS Hall AS1
Environment Control (Regular Session)	
Chair: Linker, Raphael	Tech.

15:00-15:20	Th3A.1

Minimal Heating and Cooling in a Modern Rose Greenhouse, pp. 282-287.

van Beveren, Peter	Wageningen Univ.
Bontsema, Jan	Wageningen Univ. and Res. Centre
van Straten, G	Wageningen Univ.
Van Henten, Eldert Jan	Wageningen Univ.

15:20-15:40	Th3A.2

Design of a Density Sensor Based on Piezoelectric Crystals for the Identification of the Density Profile in a Wastewater Treatment Plant Settler, pp. 288-292.

| Munoz, Jose Aldemar | Tolima Univ. |
| Caicedo, Alexander | Leuven Univ. |

15:40-16:00	Th3A.3

Video Enhancement Methods for Monitoring Submersible Biological Resources, pp. 293-298.

Chernov, Vladimir	Univ. of Vaasa
Koljonen, Janne Tapio	Univ. of Vaasa
Alander, Jarmo	Univ. of Vaasa
Bochko, Vladimir	Univ. of Vaasa

16:00-16:20	Th3A.4

Model Predictive Control for Real-Time Irrigation Scheduling, pp. 299-304.

Saleem, Syed Khusro	NICTA
Delgoda, Dilini	The Univ. of Melbourne
Ooi, Su Ki	The Univ. of Melbourne
Dassanayake, Kithsiri B	The Univ. of Melbourne
Yue, Liu	Shanghai Univ.
Halmamuge, Malka	The Univ. of Melbourne
Malano, Hector	The Univ. of Melbourne

16:20-16:40	Th3A.5

Multivariable Greenhouse Climate Control Using Dynamic Decoupling Controllers, pp. 305-310.

| Paraforos, Dimitris S. | Univ. of Hohenheim |
| Griepentrog, Hans W. | Univ. of Hohenheim |

Th3B	TUAS Hall TU1
Instrumentation and Sensing (Regular Session)	
Chair: Polder, Gerrit	Wageningen Univ.

15:00-15:20	Th3B.1

Monitoring the Flow of Seeds in Grain Drill Using Fiber Sensor, pp. 311-314.

| Al-Mallahi, Ahmad Ali | HOKKAIDO Univ. |
| Kataoka, Takashi | Hokkaido Univ. |

15:20-15:40	Th3B.2

Prediction and Evaluation for Leveling Performance in Rotary Tiller, pp. 315-320.

Hirasawa, Kazuaki	Yanmar Co., Ltd.
Kataoka, Takashi	Hokkaido Univ.
Kubo, Takayuki	Res. and Development Center, Yanmar Co., Ltd.

15:40-16:00	Th3B.3

Farmland Monitoring by Sensor Networks and Airships, pp. 321-326.

Gerke, Michael	FernUniversitaet in Hagen
Masár, Ivan	FernUniversität in Hagen
Borgolte, Ulrich	FernUniversitaet in Hagen
Roehrig, Christof	Univ. of Applied Sciences Dortmund

16:00-16:20	Th3B.4

Bacterial Detection for Food Inspection by Using a Metallic Mesh Sensor, pp. 327-330.

Suzuki, Tetsuhito	Kyoto Univ.
Ogawa, Yuichi	Kyoto Univ.
Kondo, Naoshi	Kyoto Univ.
Kondo, Takashi	Murata Manufacturing Company
Kamba, Seiji	Murata Manufacturing Company

16:20-16:40	Th3B.5

Measurement of Somatic Cell Count in Cow's Raw Milk for Detecting Mastitis by Using Attenuated Total Reflection Terahertz Spectroscopy, pp. 331-335.

Naito, Hirotaka	Div. of Environmental Science and Tech. Graduate Schoo
Ogawa, Yuichi	Kyoto Univ.
Kubota, Asuka	Hokkaido Res. Organization Agricultural Res. Department
Kondo, Naoshi	Kyoto Univ.