Chair Bioproduction Engineering

2.5.14 Laboratory : Agricultural Process Engineering

Member :	Professor	Kondo, Naoshi, Ph.D
	Associate Professor	Ogawa, Yuichi, Ph.D
	Doctor's program	8
	Master's Program	12
	Undergraduate	6
	Other	2
	Researcher	2

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Blood Vitamin A Level Measurement in Beef Cattle

Vitamin A (V.A) in cattle blood is an important indication of managing the beef quality in Japan. The V.A level should be maintained low level for the beef quality and kept above 30 IU/dl from 16 months to 24 months. Since the V.A deficiency (less than 30 IU/dl) induces serious diseases in cattle, it is essential to monitor the V.A level carefully. The conventional blood test is used for detecting the V.A level, which is time-consuming, expensive, and stressful to the cattle. Pupil color reflection is noninvasively investigated by several sensors for developing an optimum method to measure the blood V.A.

b) Machine Vision for Fruit Grading System

Algorithms are investigated for inspect round shape fruits such as tomato and citrus using TV cameras. Especially for citrus fruits, fluorescence images are acquired to detect rotten fruits, which is difficult to be find even by human eyes, because their skins contain fluorescent substances which can be reacted by ultraviolet light.

c) Comfort and Automation in Operations at Agricultural Facilities

Generally speaking, there are many kinds noise sources in agricultural facilities and operators often work under noisy conditions. Especially in grading systems, they are sometimes in more than 90 dB noise for more than several hours. To communicate with operators one another, a virtual low-noise space around operators' ears under noisy environment in facility has been studied for keeping safety and comfortable working condition. Robotization and automation projects are being conducted in greenhouse or grading facilities. A tomato cluster harvesting robot and an asparagus harvesting robot in greenhouses are being developed.

d) Informatization of Agricultural Products

Grading systems are the largest sources to obtain many kinds of information on agricultural products. TV cameras and NIR inspectors can give us information added products by their images and spectral data. A mobile grading robot to which the grading function was installed has been investigated. In this project, a mobile citrus fruit grading robot was made as a trial. The grading robot can extracted fruit grading information as well as tree information while human operators harvest fruit and it immediately grade the harvested fruits. This makes not orchard management but tree management in the orchard and guides precision agriculture in citrus production.

e) Measurement of living fish volume under the water

Aquaculture is expected to achieve a production of higher quality and yield, a production of secure and safe fresh fish and a reduction of environmental load by optimal feeding. Fish sensing technologies for information-accumulating aquaculture are essential to establish an optimal automated system. Currently a study on measurement of each fish volume in water is being conducted by use of principle of hemholtz resonance.

f) Substance identification by Spectroscopy

Spectroscopic method has the advantage of quick and easy food evaluation. In this study, we aim for the realization of qualitative and qualitaive analysis of functional substance or nutrient component in agricultural products using spectroscopy from UV to terahertz region. Since, terahertz spectroscopy is unexplored field of study, we have conducted the fundamental research to become clear the potential of terahertz spectroscopy.

g) Development of Bio-sensors

The strong localized electric field is generated on metal surface using an interaction between periodic structure of metallic plate and incident elecrtomagnetic waves. Based on this phenomenon, this periodic structure works as a sensitive sensor of the refractive index chang in this localized electoromagnetic field. In this study, we are developing the measurement system of the cell-material interaction and detection methods of specific protein with this sensitive sensor.

A-2.Publications and presentations

a) Publications

Books

- Naoshi Kondo: Image Acquisition: Plant materials, Automation in Agriculture, Encyclopedia of Agricultural, Food and Biological Engineering edited by Dennis R. Heldman, ISBN: 978-1-4398-111-5 (hardback), 978-1-4398-2806-9 (electronic), Published 19, Oct., 2010 by Taylor & Francis

- Naoshi Kondo, Takahisa Nishizu, Yuichi Ogawa, Takahiro Hayashi, Hiroshi Shimizu, Kiyokazu Goto: Physical and Biological Properties of Agricultural Products (2)--Acoustic, Electrical, Optical, and Biochemical Properties--, Corona publishing Co., Ltd., tokyo Japan, ISBN 978-4-339-05230-5, 180 pages

- Naoshi Kondo, Mitsuji Monta, Noboru Noguchi: Agricultural Robots: Mechanisms and Practice, Kyoto University Press (2011) 348 page with CD-ROM

- Yuichi Ogawa: Biosensing application for ligand search, New Terahertz Industry, CMC publishing, Ed. Masayoshi Tonouchi, ISB：978-4-7813-0289-8, Jan. 2011.

Original Papers(including book-reviews)

- Naoshi KONDO, Koki YATA, Michihisa IIDA, Tomoo SHIIGI, Mitsuji MONTA, Mitsutaka KURITA and Hiromi OMORI: Development of an End-Effector for a Tomato Cluster Harvesting Robot, EAEF 3(1): 20-24 (2010)

- M. Aboonajmi, A. Akram, T. Nishizu, N. Kondo, S.K. Setarehdan, A. Rajabipour: An ultrasound based technique for the determination of poultry egg quality, Res. Agr. Eng., Vol.56, No.1: 26-32, 2010

- Noriko TAKAHASHI, Naoshi KONDO, Nguyen Quoc TUAN, Shoichi MANO, Tomoo SHIIGI, Hiroshi SHIMIZU, Moriyuki FUKUSHIMA, Fumiyuki IWAKI, Osamu WATANABE, Kazuyuki FUKUZONO, Mamoru NAKANO: Serum Vitamin A Level Measurement in Slaughtered and Live Cattle Using Multispectral Imaging, EAEF 3(2): 42-46 (2010)

Reviews

- Yuichi Ogawa: Terahertz applications for agliculture and food industry, BIO INDUSTRY, 27(10), 20-26(2010)

- Yuichi Ogawa: Food inspection using terahertz tecnology, Equipment of food machinery, 47(9), 53-58(2010)

- Noiki Oda, Hajime Yoneyama, Masahiko Sano, Harutugu Kurashina, Norito Sasaki, Iwao Hosako, Tokuhiko Sekine and Yuichi Ogawa: Development of Terahertz array sensor and camera based on uncooled microbolometer, Deffense technology journal, 34(4), 28-35 (2010)

Patents

- Yuichi Ogawa, Takashi Kondo, Kazuhiro Takigawa and Seiji Kanba, "Measurement device, method and production method," 2011-079397, Murata manufactuaring Co., (application: 31 March 2011).

A-3.Off-campus activities 1

Membership in academic societies

- Kondo, Naoshi : Kansai Branch, Japanese Society of Agricultural Machinery (Councilor), Japanese Society of Environment Control in Biology (Councilor), Japanese Society of Agricultural Machinery (Director), Japanese Society of Mechanical Engineering(Committee member of paper award), Japanese Society of Agricultural Machinery (Editor-in-Chief), Japan Association of International Committee of Agricultural and Biosystems Engineering (representative delegate)

- Yuichi Ogawa : Japanese Society of Agricultural Machinery (Associate editor (Financial affairs)), Visiting Researcher, Terahertz Sensing and Imaging Laboratory, RIKEN , Committee member, Illuminating Engineering Institute of Japan, Committee member,The Spectroscopical Society of Japan

A-3.Off-campus activities 2

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Grant-in-Aid for Challenging Exploratory Research : Kondo, Naoshi : Living fish volume measurement by Helmholtz resonance

- Grant-in-Aid for Publication of Scientific Research Results : Kondo, Naoshi : Agricultural Robot : Mechanisms and Practice

2.Other Research Grants

- National Agriculture and Food Research Organization : Kondo, Naoshi : Development of lavorsaving technologies on controlled-environement horticultural production

- National Agriculture and Food Research Organization : Kondo, Naoshi : Development of automation on plant cutting by use of small scale robotic system

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Kondo, Naoshi: AABEA(Editor-in-Chief), SPIE Conference DS209 (Defense, Security, Sensing), Sensing for Agriculture and Food Quality and Safety, Program Committee Member, Agricontrol2010，IFAC, IPC Chair , COMPAG(Computers and Electronics in Agriculture)(Editorial Board)

- Yuichi Ogawa: AABEA（Associate editor (Financial affairs)）, Agricontrol2010 (International Program Committee)

International meetings(country,roles)

- Kondo, Naoshi：National Academy of Agricultural Science (NAAS) and Korean Society of Agricultural Machinery (KSAM), (Korea, Invited speaker), International Agricultural Engineering Conference 2010 (IAEC 2010)（China, Invited speaker）, The Second Annual Indonesian Scholars Conference in Taiwan (AISC 2011) (Taiwan, Invited speaker), The International Workshop on Agriculture & Mechanization Challenge and Opportunity for Globalization(Thailand, Invited speaker)

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Research Fellow 1（China）
- Invited researcher 1（China）
- Invited researcher 1（USA）
- Invited researcher 2（Korea）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level：Introduction to Agricultural and Environmental Engineering (Kondo), Agricultural Process Machinery (Kondo and Ogawa), Automatic Control (Kondo), Instrumentation and Measurement for Biological Objects (Kondo), Introduction to Foreign Literature on Agricultural Machinery (Kondo), Laboratory course in agricultural machinery II (Ogawa), Seminar in Agricultural and Environmental Engineering(Kondo and Ogawa), Seminar in Agricultural Machinery(Kondo and Ogawa), On-job-Training for Agricultural and Environemntal Engineering (Kondo)

- Graduate level： Seminar I on Agricultural Process Engineering (Kondo and Ogawa), Physical Properties of Agricultural Products (Ogawa), Laboratory Course in Agricultural Engineering (Kondo and Ogawa), Seminar II on Agricultural Process Engineering (Kondo and Ogawa), Basic Concepts in Sustainable Agriculture (Kondo)

B-3.Overseas teaching 1

International students

- International students : Master 3 (China 2, Bangladesh 1) Doctral 5 (China 2, Indonesia 2, Bangladesh 1) Research Students 3 (China 2, Myanmar 1) Auditing Students 3 (Korea)

B-3.Overseas teaching 2

Lectures and seminars

- Kondo, Naoshi

Lecture on Robotics in Bioproduction Systems(Guest Professor) : College of Biosystems Engineering & Food Science, Zhejiang University(China)

C.Other Remarks

- Kondo, Naoshi : Council for University Chartering and School Juridical Person, MEXT, Guest Researcher, Industrial Technology Center of Nagasaki