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# Soojin Jun

Post-doctor, Department of Food, Agricultural &  
 Biological Engineering, Ohio State University

## Interests

Research and development in integrated food and biological process systems : system design, sensor/control, modeling and optimization  
 Food safety and microbiology  
 Nano technology and applications, Biosensors  
 Management and automation of food processing  
 Food packaging

## Education

Degree: Ph.D. in Agricultural & Biological Engineering  
 University: Penn State University, USA  
 Year: 2002 [3.97/4.0]  
 Dissertation: Selective Far Infrared Heating of Food Systems

Degree: M.S. in Food Science & Technology  
 University: Seoul National University, Korea  
 Year: 1998 [3.85/4.3]  
 Dissertation: Design of Auto-Feeding System for Microwave Extraction of Food

Degree: B.S. in Food Science & Technology  
 University: Seoul National University, Korea  
 Year: 1996 [3.0/4.3]

## Employment

07/04 - Present Post-doctor, Department of Food, Agricultural & Biological Engineering, The Ohio State University  
 07/02 - 06/04 Post-doctor, Department of Agricultural & Biological Engineering, The Pennsylvania State University  
 01/99 - 06/02 Research Assistant, Department of Agricultural & Biological Engineering, The Pennsylvania State University

## Honor & Award

- Scholarships, Seoul National University
- Research Assistantship in Ph.D., Pennsylvania State University

## Experience

### Research

- Machine design, Fabrication, Instrumentation and Process Control
- *Ohmic heating system (Current NASA project):* Develop and optimize a reusable package and system for processing food and waste products by ohmic heating.
  - *Plate Heat Exchangers (Fluid food pasteurization):* Develop the

computational monitoring & control system for temperature and flow rate in PHE. Applied to minimize milk fouling/microbial infection during milk pasteurization. Anti-fouling surface coating technology using electroless Teflon and carbon nanotubes (CNTs).

- *Infrared heating system*: Complete design, fabrication, instrumentation, and process control. Applied to selective heating for quality and microbial control.
- *Pulsed electric field heating system*: Design of high voltage (10kV) system and system safety factor. Applied to inactivate bacteria in milk.
- *Microwave Assisted Extraction system*: Design of waveguide and cavity optimal for wave propagation, Co-work with Samsung electrics, Co. Applied to extract the pigment components from food materials.
- *Ohmic heating system (in Korea)*: Complete design of power & frequency generator. Applied to selective food thawing using various dielectric properties.
- *Pulsed UV-light system*: Control of pulse power and frequency. Applied to fungal & toxins inactivation.
- *Refrigeration*: Control of cold air flow direction and temperature, based on neural network. Measure the velocity field using an anemometer. Co-work with Samsung electrics, Co.
- *Microprocessor-based controller for green house*: Design of control module, sensors, user interface, and data communication. Control of pH, humidity, temperature and illuminance to optimize the environmental conditions of green house.

#### Modeling and Computer Programming

- 2D, 3D thermodynamic and hydrodynamic performances of plate heat exchangers
- 3D dynamic fouling model of plate heat exchangers
- Radiative heat transfer modeling during infrared processing
- Thermal death kinetics for integrated prediction of lethality during infrared for processing
- Wave propagation and heat transfer model during microwave processing
- Control volume approach to modeling heat and mass transfer
- Specialty for programming of data communication and interface
- Very proficient in: Visual C++, Java, LabView, LabWindows and Matlab
- Proficient in commercial software packages: FLUENT, I-DEAS and graphics
- Proficient in PLC and assembly language programming
- Familiarity with PCB mapping of a microprocessor-based

controller

#### Biosensors

- Coursework completed in Ph.D.
- SPR sensor to detect the chemical and microbial status of fluid foods
- Design of the electrochemical cell and the data acquisition system in a microdialysis-coupled flow injection amperometric sensor

#### Nano applications

- Carbon nanotubes (CNTs) application
- Non stick hydrophobic coating of CNTs on heat exchange surface
- CNT-based biosensors

#### Microbiology and Biology

- Relevant coursework completed in B.S.
- Fermentation and basic DNA cloning: B.S. graduation thesis
- Experience in control of molds, bacteria (pathogenic and nonpathogenic) and toxins (Aflatoxin and Fumonisin)
- Insects: control of Indian Moth and Mealworm using infrared & pulsed UV heating

#### Food Chemistry

- Familiarity with a range of analytical food evaluation techniques
- Quantitative analysis of food components
- Mechanical measurements of food materials
- Bioinstrumentation: SAW based Z-nose, FTIR, PAS, and Raman spectroscopies

### **Teaching**

#### Private tutoring

- Math, physics, and chemistry: teach more than 40 high school students for 9 years

#### Teaching Assistant

ABE, Penn State

- Course title: Physical principles in food process engineering (ASM 425)
- Basic engineering principles of heat and mass transfer, fluid flow and energy equations in food processing
- Counseling senior level students

Guest Lectures

ABE, Penn State

- Real time data acquisition for process control (ABE 405, Instrumentation, Measurement and Control)
- Cell Structure and tissue in Ag/Food materials (ABE 404, Food & Biomaterial Properties)

**Laboratory development**

Lab instructor (ASM 425)

- Organizing & instructing 14 different lab activities/semester
- Handouts preparation and reports grading (38 students)

Food Engineering Laboratory in ABE

- Setting up communication network, administrating computers
- Instrumentation

**Projects**

Reheating and sterilization technology for food, waste and water (NASA)

- FABE, OSU
- Development of a reusable food container that can be used either for reheating food or for sterilization of packaged contents in situ ohmic heating technology

Minimizing milk fouling in plate heat exchangers (California Institute for Energy Efficiency (CIEE))

- ABE, Penn State
- Optimization of plate heat exchanger to minimize fouling, enhance energy efficiency and reduce water usage

Post-harvest dairy product safety (USDA)

- ABE/FS, Penn State
- Measurement, model development and validation of temperatures and fluid flow in HTST regenerative heating systems

Design of selective IR heating system for food components (USDA, Penn State Center for Food Manufacturing)

- ABE, Penn State
- Build the infrared system to selectively heat food components using the optical bandpass filter and apply for inactivation of fungal spores in corn meal. Validate the selective heating effect with a numerical approach

Microwave-assisted extraction system (Korean Ministry of Agriculture, Forestry, and Fishery)

- Seoul National University, Korea
- Design of U-column microwave system to extract food pigment and explore flow characteristics in packed bed of food powders

## Service

### Paper review

- Transactions of the ASAE
- Journal of Drying Technology
- Journal of Food Protection
  - Effect of pulsed electric field processing parameters on Salmonella Enteritidis inactivation (Korolczuk, et al., 2004)
- A review chapter on infrared properties of foods by Dr. Ashim Datta (Cornell University)

### Proposal writing

- Nanoscale hydrophobic surface treatment fundamental study to minimize fouling during thermal processing (USDA-NRI, 2005)
- Innovative hydrophobic surface treatment technology for food processing (USDA-SBIR, 2004 & 2005) - Awarded
- Carbon Nanotubes (CNT's) for Quantum Gains in Efficiency During Thermal Processing of Foods (CoAS, PSU, Seed Grant, 2004) – CoPD, Awarded
- Innovative nanoparticulates and novel electroless surface coatings with integrated sensor approach to minimize fouling during juice pasteurization (USDA-NRI, 2004)
- Surface coating technique to minimize milk fouling in plate heat exchangers (California Institute for Energy Efficiency (CIEE),2003) – Awarded
- Control of insect pests - infrared radiation and pulsed UV treatment (IPM, 2001)
- A novel thermal & non-thermal approach to pest management (USDA-Northeastern Pest Management Center, 2000)

### Mentoring graduate students

## Publication

- Soojin Jun, Brian Heskitt, and Sudhir Sastry, 2005, Modeling and Optimizing of Pulsed Ohmic Heating of Foods inside the Flexible Package, **Journal of Food Process Engineering** (In Review)
- Soojin Jun and V. M. Puri, 2005, Potential Milk Fouling Area in Plate Heat Exchangers, **Innovative Food Science and Emerging Technology** (In Review)
- Soojin Jun and V. M. Puri, 2004, 3D Fouling Model of Plate Heat Exchangers using Computational Fluid Dynamics, **International Journal of Dairy Technology** (In Review)
- Soojin Jun and V. M. Puri, 2005, A 2D dynamic model for

fouling performance of plate heat exchangers, **Journal of Food Engineering** (Accepted)

- Soojin Jun and V. M. Puri, 2004, Fouling Model for Heat Exchangers in Food Processing: A Review, **Journal of Food Process Engineering** (Accepted)
- Soojin Jun and V. M. Puri, 2004, Development of interactive computational model of temperature and moisture distributions of microwaved foods, **Applied Engineering in Agriculture** 20(5): 677-682
- Soojin Jun and Joseph Irudayaraj, 2004, Explore the Mechanism of Selective Infrared Heating on Disinfection of Fungal Spores, **Applied Engineering in Agriculture** 20(4): 481-485
- Soojin Jun, V. M. Puri, and R. F. Roberts, 2003, A dynamic model for thermal performance of plate heat exchangers, **Transactions of the ASAE** 47(1): 213-222
- Soojin Jun and Joseph Irudayaraj, 2003, Selective Far Infrared Heating System - Design and Evaluation (Part I), **Journal of Drying Technology** 21(1):51-67
- Soojin Jun and Joseph Irudayaraj, 2003, Selective Far Infrared Heating - Spectral Manipulation (Part II), **Journal of Drying Technology** 21(1):69-82
- Soojin Jun and Joseph Irudayaraj, 2003, A Dynamic Fungal Inactivation Approach using Selective Infrared Heating, **Transactions of the ASAE** 46(5):1407-1412.
- S. Jun, J. Irudayaraj, A. Demirci, and D. Geiser, 2003, Pulsed UV-light Treatment of Corn meal for Inactivation of *Aspergillus niger* Spores, **International Journal of Food Science and Technology** 38:1-6
- R. Ranjan, J. Irudayaraj and S. Jun, 2002, Simulation of Infrared Drying Process, **Journal of Drying Technology** 20(2):363-379
- R. Ranjan, J. Irudayaraj, and S. Jun, 2002, Simulation of Three-Dimensional Infrared Drying using a set of Three-coupled Equations by the Control Volume method, **Transactions of the ASAE** 45(5): 1661-1668
- Ranjan, R., J. Irudayaraj and S. Jun, 2001, A Three-Dimensional Control Volume Approach to Modeling Heat and Mass Transfer in Foods Materials, **Transactions of the ASAE** 44(6): 1975-1982
- Jun S.J. and Chun J.K., 1998, Design of U-column Microwave-Assisted Extraction System and its Application to Pigment Extraction from Food, **Food and Bioproducts Processing**, 76 (C4): 231-236
- Soo-Jin Jun, Tae Wha Moon and Jae-Kun Chun, 1998, Flow Characteristics in Packed bed of Cape Jasmine powders in U-column Microwave Assisted Extraction System, **Food Engineering Progress**, 2(1): 55 – 62

**Conference****Poster**

- Soojin Jun, R. Ranjan, J. Elkind, D. Barthalomew and J. Irudayaraj, Monitoring chemical and microbial status using surface plasmon resonance based on biosensor, 94<sup>th</sup> Annual International meeting of ASAE, July 29-Aug 1, 2001, Sacramento, California
- J. Irudayaraj and S. J. Jun, Automated Infrared system for selective heating of food, 93<sup>rd</sup> Annual International meeting of ASAE, July 9-12, 2000, Milwaukee, Wisconsin

**Presentation**

- Hatice Ozlem Ozden, Soojin Jun, and V. M. Puri, Sensitivity analysis of plate heat exchangers using FLUENT, 2004 NABEC conference, June 27-30, University Park, Pennsylvania.
- Soojin Jun and V. M. Puri, Fouling performance of plate heat exchangers using a 2D dynamic model, 2004 NABEC conference, June 27-30, University Park, Pennsylvania.
- Soojin Jun and V. M. Puri, Development of user-friendly interface for computational model of temperature and moisture distributions during microwave heating of food materials, 2003 ASAE Annual International Meeting, July 27-30, 2003, Las Vegas, Nevada
- Soojin Jun and V. M. Puri, Dynamic modeling of thermal performance of multichannel plate heat exchangers, 2003 ASAE Annual International Meeting, July 27-30, 2003, Las Vegas, Nevada
- Soojin Jun and Joseph Irudayaraj, Exploring a selective heating technique for food components using Infrared radiation, The 2002 IFT Annual Meeting, June 15 -19, 2002, Anaheim, California
- Soojin Jun and Joseph Irudayaraj, Exploring the disinfection of fungal spores in corn meal using selective IR heating technique, The 2002 IFT Annual Meeting, June 15 -19, 2002, Anaheim, California
- S. Jun and J. Irudayaraj, Exploring the concept of selective heating of food powders, Fine powder processing 2001 - An international conference on Fine grinding, Oct 1-3, 2001, The Pennsylvania State University
- J. Irudayaraj and S. Jun, Design of selective heating system for food using Far infrared radiation, Conference on Technologies for the new millennium in commemoration of the 53<sup>rd</sup> anniversary of Research & Development Associates for military food and packaging systems, Inc. Fall '99 meeting, Nov 1-2, 1999, Pittsburgh, PA
- S. Jun and Joseph Irudayaraj, Design of selective heating system for food using Far infrared radiation, At meeting of The Center for Food Manufacturing (CFM), Jun., 2001

**Relevant Courses****Ph.D.**

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|----------------------------|-------------------------|
| ▪ Microwave engineering    | ▪ Micromechatronics     |
| ▪ Automatic control system | ▪ Multivariate analysis |

- FEM
- Biosensors
- Radiative Heat Transfer
- Instrumentation and Control
- Digital Process/Control

**M.S.  
&  
B.S.**

- Food microbiology
- Biochemistry
- Food chemistry
- Biochemical engineering
- Fermentation chemistry
- Heat transfer
- Food process automation
- Food preservation
- Food sanitation
- Food process engineering
- Agricultural food processing
- Microprocessor application
- Robotics
- Dynamics

**Significant Coursework  
Projects**

Application of surface plasmon resonance (SPR) biosensors

- Correlate the oxidation levels in vegetable oil w.r.t. temperature profile to refractive index values
- Detect the microbial status in liquid medium: *E. coli*, *B. subtilis*, and *S. aureus*

Radiative Heat transfer Model

- Analyze the radiative heat transfer in a radiant burner
- Apply the Monte-Carlo method to determine generalized exchange factors

Prediction of Thermal Distribution in 2D Meat Model using Finite Element Analysis

- Predict temperature and heat flux distribution of a cylindrical meat sample
- Use I-DEAS software package for pre-processing, solving, and post-processing

Automatic Control for IR Heating System

- Derivation of discrete plant transfer function
- Evaluation of the proportional control parameters
- Integral control action on the system performance

Digital PID control of Pendulum-Cart System

- Control crane location and self-erecting of pendulum
- Develop motion equation and state space model
- Feedback gain simulated for system controllability
- Member of the Korean Society for Industrial Food Engineering

**Society**

(KSIFE)

- Member of the Institute of Food Technologists (IFT)

## References

Dr. Sudhir Sastry

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