Jaepil Ban

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Education

Mar'12- **Pohang University of Science and Technology**, Pohang, South Korea
Candidate for integrated MS and PhD in Electrical Engineering
Advisor: Sangwoo Kim

Mar'04-Feb'12 **Ajou University**, Suwon, South Korea
Bachelor of Electronic and Electrical Engineering

Research Interests

My research area includes: control and stability analysis of linear/nonlinear dynamical systems such as hybrid systems, reset control systems, networked control systems, and industrial control systems. I am currently interested in the stability and energy scheduling of modern power systems including microgrids with distributed energy sources.

Research Experiences

Mar'18- **Design of Alpha Grid platform and research on components technology**
Collaborated with Korea Electric Power Cooperation *Supervisor: Prof. Sang Woo Kim*
- Investigated the influence of the electrical fault of generators for a fuel-cost curve.
- Developing a distributed optimal energy scheduling algorithm with faulty distributed energy resources.

Aug'17-Feb'18 **Development of the artificial-intelligence-based control algorithm for automation of POSCO EMLPVD process**
Collaborated with PIBEX (R&D Company of POSCO) *Supervisor: Prof. Sang Woo Kim*

· Developed a physical vapor decomposition process model by using an artificial neural network.
· Proposed an online-model-learning algorithm to enhance the accuracy of the neural network model in an insufficient-data environment.

Jun'17-Mar'18 **Development of simulator for Senzimir mill and improvement on control algorithm**
Collaborated with POSCO *Supervisor: Prof. Sang Woo Kim*
· Derived a dynamic model of the Sendzimir mill (Z-mill) by using its geometry and force transitions between rolls.
· Identified the unknown parameters of the Z-mill, which is highly nonlinear, by using operation data.
· Constructed a linear mill matrix from operation data by using a least square method.
· Developed an optimal flatness control of the steel product based on the model.

May'16-Aug'16 **Welding point detection algorithm of lighting for vision system for automatic welding in shipbuilding process**
Collaborated with Samsung Heavy Industries *Supervisor: Prof. Sang Woo Kim*
· Developed an end-point-detection algorithm for noisy images from a lighting vision system.
· Proposed a morphological-operation-based ellipsoid fitting for detecting the welding point and the proposed algorithm is robust and accurate in detecting the points compared to the points-based least square algorithm.

Dec'14-Sep'15 **Real-time control of finishing mill for lateral movement of a strip by using programmable logic controller**
Collaborated with POSCO *Supervisor: Prof. Sangchul Won*
· Developed a hardware in the loop simulator for 7-stand finishing mill with PLC.
· Proposed an active disturbance rejection control for lateral movement of finishing mill to cope with model uncertainty and disturbances and applied it to the real plant.
· Developed a graphic user interface for the developed hardware in the loop simulator.
· Proposed a sensor fault detection algorithm by using proportional-integral observer and successfully detected the sensor fault of the finishing mill simultaneously.

Oct'13-Oct'14 **Design of an embedded controller and control algorithm for heat pump systems**
Collaborated with BnF Solution *Supervisor: Prof. Sangchul Won*
· Designed an embedded control system with a microcontroller unit (MCU) for a two-stage heat pump to regulate superheat temperature of a refrigerant and control water temperature.
· Designed a windows API-based monitoring program of a heat pump by using RS-232 modbus protocol between PC and MCU.
· Proposed an optimal energy consumption algorithm for an on/off-controlled heat pump system and reduced electric power consumption achieving satisfied level of water temperature.

Jan'13-Sep'13 **Estimation of 3-dimensional temperature distribution for indoor air-flow control**
Collaborated with LG Electronics *Supervisor: Prof. Sangchul Won*

- Designed a temperature measurement and monitoring system with a thermopile array sensor by using LabVIEW.
- Proposed an estimation algorithm of temperature distribution in a room by using adaptive-network-based fuzzy inference system (ANFIS).
- Proposed an online human-detection algorithm by using temperatures obtained from a thermopile array sensor.

Feb'12-Jul'13 **Active torque control for 1-Piston rotary compressor**
Collaborated with LG Electronics *Supervisor: Prof. Sangchul Won*

- Designed a disturbance observer-based algorithm for reducing the vibration of 1-piston rotary compressor of an air conditioner.
- Proposed an adaptive disturbance compensation method to compensate unknown time-delay on phase measurement induced by the sensorless algorithm for motor speeds.

Mar'11-Sep'11 **Development of sensing and control algorithm of a quadrotor UAV**
Undergraduate Design Project *Supervisor: Prof. Suk-Kyo Hong*

- Designed a low cost IMU sensor system by using a 3-axis gyro in Wii MotionPlus and 3-axis accelerometer.
- Proposed parallel core processors to perform controlling rotors and processing sensor signal simultaneously.

Publications & talks

Journal articles

1. **Controllability and Observability of Singular Hybrid Linear Systems**
Jaepil Ban, Sang Woo Kim
(Preparing for submission)

2. **Design of Reset Control for SISO Linear Systems**
Jaepil Ban, Minseok Seo, Sang Woo Kim
IEEE Transactions on Automatic Control (Under review)

3. **Improved co-design of event-triggered dynamic output feedback controllers for linear systems**
Jaepil Ban, Minseok Seo, Taedong Goh, Hyeyun Jeong, Sang Woo Kim
Automatica (Provisionally accepted)

4. **Robust H_∞ finite-time control for discrete-time polytopic uncertain switched linear systems**
Jaepil Ban, Wookyong Kwon, Sang Woo Kim
Nonlinear Analysis: Hybid Systems 20: 348-367, 2018

5. **Mold Oscillation Feedforward Control Algorithm for Sinusoidal Oscillation of Various Asymmetries**

Seung Hoon Kim, Minseok Seo, **Jaepil Ban**, Nam Woong Kong, Sang Woo Kim
ISIJ International 57.11: 2016-2021, 2017

6. **Multicriteria adaptive observers for singular systems with unknown time-varying parameters**
Wookyong Kwon, **Jaepil Ban**, Soo Hee Han, Changsoo Lee, Sangchul Won
Mathematical Problems in Engineering, 2017

Conferences

1. **Design of Reset Control for SISO Linear Systems**
Jaepil Ban, Sang Woo Kim
IEEE International Conference on Control and Automation, Edinburg, Scotland, 2019.

2. **Stability and $\mathcal{L}_2$-gain analysis of Impulsive Switched Systems with Average Dwell Time: Application to Hybrid Control**
Jaepil Ban, Wookyong Kwon, Sang Woo Kim
American Control Conference, Seattle, USA, 2017.

3. **Localization of slab identification numbers using deep learning**
Sang Jun Lee, **Jaepil Ban**, Hyeyeon Choi, Sang Woo Kim
2016 16th International Conference on Control, Automation and Systems (ICCAS), IEEE, 2016.

4. **Decentralized H_∞ control of large-scale descriptor systems using proportional-plus-derivative state feedback**
Sungbin Kim, Wookyong Kwon, **Jaepil Ban**, Sangchul Won
2015 15th International Conference on Control, Automation and Systems (ICCAS), IEEE, 2015.

5. **Proportional multiple-integral observer based sliding mode control for linear systems with mismatched disturbance**
Hyung Woong Lee, **Jaepil Ban**, Sangchul Won
2015 15th International Conference on Control, Automation and Systems (ICCAS), IEEE, 2015.

6. **Fault estimation and fault-tolerant control of vapor compression cycle systems**
Jaepil Ban, Wookyong Kwon, Sangchul Won
2015 41st Annual Conference of the Industrial Electronics Society, IECON, IEEE, 2015.

7. **Generalized complex projective synchronization of chaotic complex systems with unknown parameters**
Jaepil Ban, Jinwoo Lee, Sangchul Won
2014 14th International Conference on Control, Automation and Systems (ICCAS), IEEE, 2014.

8. **Synchronization of two different chaotic systems using terminal sliding mode with disturbance observer**
Jaepil Ban, Jinwoo Lee, Sangchul Won
In *Proceedings of SICE Annual Conference 2013*, pp. 2575-2580.

Grants, honors & awards

2009-2 Self-development Scholarship, Ajou University
2010-2011 Honor Scholarships for four semesters, Ajou University

Computer languages

MATLAB, Simulink, Appdesigner, Python, Tensorflow, OpenAI Gym, C, Windows API, PLC programming, LabView, OrCAD, PSpice, LaTeX