

Jaepil Ban

Energy Systems Laboratory
Department of Electrical Engineering
POSTECH
Cheongam-ro 77
Pohang, Nam-gu 37673 South Korea
Phone: +82-54-279-5086
Email: banjp117@postech.ac.kr
URL: <http://positiveban.github.io/>

Current position

Feb'21- *Postdoctoral Research Associate*, Electrical Engineering,
Pohang University of Science and Technology, South Korea

Education

Mar'12-
Feb'20 Ph.D., Electrical Engineering,
Pohang University of Science and Technology, South Korea
Advisor: Sangwoo Kim

Mar'04-
Feb'12 B.S., Electronic and Electrical Engineering
Ajou University, South Korea

Research Interests

My research area includes: convex optimization-based controller design and stability analysis of linear/nonlinear dynamical systems such as hybrid systems, reset control systems, switched/impulsive systems, networked control systems, and industrial control systems. I am currently interested in the application of reinforcement learning to optimal control, state estimation, and system identification of power and industrial control systems.

Publications & talks

JOURNAL ARTICLES

1. **Low-Order Model Identification and Adaptive Observer-Based Predictive Control for Strip Temperature of Heating Section in Annealing Furnace**
Minseok Seo, Jaepil Ban, Mingi Cho, Bae Young Koo, Sang Woo Kim
IEEE Access 9: 53720-53734, 2021

2. **Decentralization of Phasor-Aided State Estimation Using Local State Extension**
Jaepil Ban, Jaeboem Im, Young-Jin Kim
IEEE Transactions on Power Systems, Early Access, 2021
3. **Static Model Identification for Sendzimir Rolling Mill Using Noise Corrupted Operation Data**
 Minseok Seo, **Jaepil Ban**, Bae Young Koo, Sang Woo Kim
IEEE Access 8: 150685-150695, 2021
4. **Stability and Stabilization of Singular Hybrid Linear Systems: An LMI Approach**
Jaepil Ban, Sang Woo Kim
 (Under preparation - 80%)
5. **Observer design of descriptor impulsive systems**
Jaepil Ban, Sang Woo Kim
 (Under preparation - 90%)
6. **Reachability and State-feedback Stabilization of Descriptor Impulsive Linear Systems**
Jaepil Ban, Sang Woo Kim
 (Under review)
7. **Attention-based RNN Diagnosis Method for Interturn Short-Circuit Fault in PMSMs**
 Hojin Lee, Hyeyun Jeong, Gyokwon Koo, **Jaepil Ban**, Sang Woo Kim
IEEE Transactions on Industrial Electronics 68.4: 3445-3453, 2021
8. **H_2 Reset Controller Design for Linear Systems using Piecewise Quadratic Lyapunov Functions**
Jaepil Ban, Minseok Seo, Sang Woo Kim, Young-Jin Kim
 (Under review)
9. **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 111, 2020
10. **Robust H_∞ finite-time control for discrete-time polytopic uncertain switched linear systems**
Jaepil Ban, Wookyong Kwon, Sang Woo Kim
Nonlinear Analysis: Hybrid Systems 20: 348-367, 2018
11. **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
12. **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. **Optimal Power Flow for Microgrids with Faulty Generators**
Jaepil Ban, Hojin Lee, Hyeyun Jeong, Sang Woo Kim
2019 9th International Conference on Power and Energy Systems, IEEE, Perth, Australia, 2019
2. **Vertex-wise NLMS Algorithm for Signal Reconstruction of DC Power Flow**
Minseok Seo, Jaepil Ban, Sang Woo Kim
IEEE PES Asia-Pacific Power and Energy Engineering Conference, Macao, China, 2019
3. **Design of Reset Control for SISO Linear Systems**
Jaepil Ban, Sang Woo Kim
IEEE International Conference on Control and Automation, Edinburgh, Scotland, 2019.
4. **Stability and \mathcal{L}_2 -gain analysis of Impulsive Switched Systems with Average Dwell Time: Application to Hybrid Control**
Jaepil Ban, Woogyong Kwon, Sang Woo Kim
American Control Conference, Seattle, USA, 2017.
5. **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.
6. **Decentralized H_∞ control of large-scale descriptor systems using proportional-plus-derivative state feedback**
Sungbin Kim, Woogyong Kwon, Jaepil Ban, Sangchul Won
2015 15th International Conference on Control, Automation and Systems (ICCAS), IEEE, 2015.
7. **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.
8. **Fault estimation and fault-tolerant control of vapor compression cycle systems**
Jaepil Ban, Woogyong Kwon, Sangchul Won
2015 41st Annual Conference of the Industrial Electronics Society, IECON, IEEE, 2015.
9. **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.
10. **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.

Research Experiences

- Mar'19-
Dec'19 **Development of dynamic temperature estimation model and predictive control algorithm based on a model predictive control (MPC)**
Collaborated with POSCO *Supervisor: Prof. Sang Woo Kim*
- Developed a dynamic model of an indirect-fired annealing furnace using its geometry and radiation heat transfer between the internal components.
 - Identified the unknown parameters of the annealing furnace by using the operation data.
 - Developed an adaptive observer-based model predictive control algorithm.
- Mar'19-
Feb'20 **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 performance degradation of generators in a fuel-cost curve.
 - Investigated the correlation between the fault indicator and degraded output power of diesel/wind turbine generators.
 - Developed an optimal energy management algorithm using distributed energy resources with performance degradation.
- Aug'17-
Feb'18 **Development of the artificial-intelligence-based control algorithm for the 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 using artificial neural networks.
 - Proposed an online-model-learning algorithm to enhance the accuracy of the neural network model in insufficient-data environments.
- Jun'17-
Mar'18 **Development of simulator for Sendzimir mill and improvement on control algorithm**
Collaborated with POSCO *Supervisor: Prof. Sang Woo Kim*
- Developed 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 by using the operation data.
 - Constructed a linear mill matrix from the operation data by using a least square method.
 - Developed a model-based flatness control algorithm of the Sendzimir mill system.
 - Developed a graphic user interface that comprehends system identification and dynamic simulation using MATLAB Appdesigner.
- 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 obtained 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 the superheat temperature of a refrigerant and to control the water temperature.
 - Designed a windows API-based monitoring program of the heat pump with a communication 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*
- Developed 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 time-delay 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*
- Developed 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.

Grants, honors & awards

2009-2 Self-development Scholarship, Ajou University
2010-2011 Honor Scholarships for four semesters, Ajou University
2021- BK21 Post-doctoral fellow, POSTECH

Computer languages

MATLAB, Simulink, Appdesigner, Python, Tensorflow, Keras, PyTorch, OpenAI Gym, PowerWorld Simulator, C, Windows API, PLC programming, LabView, OrCAD, PSpice, \LaTeX