Kyungduk Moon

Ph.D. Candidate at POSTECH, Korea
kaleb.moon@postech.ac.kr msolab.org
GitHub: kalebmoon07 Google Scholar

Education

Ph.D. in Industrial and Management Engineering *Feb 2020 – Aug 2025*
POSTECH (Pohang University of Science and Technology), Pohang, Korea

- Advisor: Prof. Kangbok Lee
- Thesis: Multilevel Optimization for Precision Medicine: A Boolean Network Control Approach
- Major: Operations Research
- GPA: 4.06/4.3

M.S. in Industrial and Management Engineering *Aug 2018 – Feb 2020*
POSTECH (Pohang University of Science and Technology), Pohang, Korea

- Advisor: Prof. Kangbok Lee
- Thesis: Strategic Location Problem for Last-mile Delivery with Relaying Drones
  - The Best Presenter Award (Department of IME, POSTECH)
- Major: Operations Research
- GPA: 4.23/4.3 (early graduation)

B.S. in Industrial and Management Engineering *Feb 2015 – Aug 2018*
POSTECH (Pohang University of Science and Technology), Pohang, Korea

- GPA: 3.91/4.3 (2nd place, Summa Cum Laude, early graduation)

Professional Experience

Visiting Predoctoral Fellow *Jun, Nov 2024*
Modèles & Technologies pour la Vérification Team
Laboratoire Bordelais de Recherche en Informatique (LaBRI) at U. of Bordeaux, Talence, France

- Host: Dr. Loïc Paulevé

Visiting Predoctoral Fellow *Jan 2024*
Department of Technology, Operations, and Statistics
Stern School of Business, New York University, New York, NY, USA

- Host: Prof. Michael L. Pinedo

Visiting Predoctoral Fellow *Jul – Aug 2017*
Operations Department
Kellogg School of Management, Northwestern University, Evanston, IL, USA

- Host: Prof. Sunil Chopra

Internship *Jul – Aug 2016*
Administration Headquarter, PMGROW Corp., Uiwang, Korea

Research Interests

- **Bilevel optimization**: Mathematical optimization, Computational complexity theory
- **Computational biology**: Boolean networks, Gene regulatory networks, Metabolic networks
- **Production planning & Scheduling**: Matheuristics, Constraint programming

Publication (*Corresponding author)

Refereed Journal Publications

[J4] **Kyungduk Moon***, Kangbok Lee, and Loïc Paulevé. Computational complexity of minimal trap spaces in Boolean networks. *SIAM Journal on Discrete Mathematics*, 38(4):2691–2708, 2024

[J3] Myungho Lee, **Kyungduk Moon**, Kangbok Lee*, Juntaek Hong, and Michael Pinedo. A critical review of planning and scheduling in steel-making and continuous casting in the steel industry. *Journal of the Operational Research Society*, 75(8):1421–1455, 2024

[J2] Juntaek Hong, **Kyungduk Moon**, Kangbok Lee*, Kwansoo Lee, and Michael L. Pinedo. An iterated greedy matheuristic for scheduling in steelmaking-continuous casting process. *International Journal of Production Research*, 60(2):623–643, 2022

[J1] **Kyungduk Moon**, Kangbok Lee*, Sunil Chopra, and Steve Kwon. Bilevel integer programming on a Boolean network for discovering critical genetic alterations in cancer development and therapy. *European Journal of Operational Research*, 300(2):743–754, 2022

Working papers

[W5] Célia Biane, **Kyungduk Moon**, Kangbok Lee, and Loïc Paulevé. A taxonomy for understanding the variety in control methods for Boolean networks. (In preparation)

[W4] **Kyungduk Moon**, Kangbok Lee*, and Loïc Paulevé. A bilevel integer programming approach for the synchronous attractor control problem. (In preparation)

[W3] Dongyun Kim, Yeonjun Choi, **Kyungduk Moon**, Myungho Lee, Kangbok Lee*, and Michael L. Pinedo. Iterated greedy algorithm with constraint programming for scheduling steelmaking-continuous casting process. (Major revision in *European Journal of Operational Research*)

- The previous version accepted to *CPAIOR 2023 Conference*

[W2] Juntaek Hong, Kangbok Lee*, **Kyungduk Moon**, Haju Jang, and Sunil Chopra. Fleet size problem with crowdsourcing for last-mile delivery and regulation effect on crowdsourcing. (In preparation)

[W1] **Kyungduk Moon**, Sunil Chopra, and Kangbok Lee*. Strategic Location Problem for Synchronized Last-mile Delivery with Relaying Drones. (In preparation)

- The previous version accepted to *MSOM 2019 Conference–Supply Chain Management SIG track*

Conference proceedings

[C4] Dongyun Kim, Yeonjun Choi, **Kyungduk Moon**, Myungho Lee, Kangbok Lee*, and Michael L. Pinedo. Iterated Greedy Constraint Programming for Scheduling Steelmaking Continuous Casting. In Andre A. Cire, editor, *Integration of Constraint Programming, Artificial Intelligence, and Operations Research*, pages 477–492, 2023

[C3] **Kyungduk Moon**, Myungho Lee, and Kangbok Lee*. Rescheduling problem for heavy cargo logistics with transporters. In *Advances in Production Management Systems. Smart Manufacturing and Logistics Systems: Turning Ideas into Action*, pages 485–493, 2022

[C2] Juntaek Hong, Kwansoo Lee, Kangbok Lee*, and **Kyungduk Moon**. An iterated greedy matheuristic for scheduling in steelmaking-continuous casting process. In *Advances in Production Management Systems. Artificial Intelligence for Sustainable and Resilient Production Systems*, pages 62–72, 2021

[C1] **Kyungduk Moon**, Sunil Chopra, Seokwon Kim, and Kangbok Lee*. Strategic location problem for synchronized last-mile delivery with relaying drones. In *SIG Meeting of 2019 Manufacturing & Service Operations Management International Conference*, 2019

Presentation (*Attended as a presenter)

Conference Presentations (International)

INFORMS 2024 *Seattle, WA, USA (Oct 20 – 23)*
2024 INFORMS Annual Meeting

- Proving an Approximation Ratio by Mathematical Programming
- Minimizing the Stay Time of Open Shop Scheduling Problems with the Unit Processing Time

INFORMS 2023 *Phoenix, AZ, USA (Oct 15 – 18)*
2023 INFORMS Annual Meeting

- Minimizing Makespan for Job Shop Scheduling Problem Using Deep Learning Model Employing Critical Paths of Schedules for Large Neighborhood Search
- Improved Iterated Greedy Constraint Programming for Scheduling Steelmaking Continuous Casting
- Analysis of Combining LPT and Multifit Algorithms for Identical Parallel Machine Scheduling to Minimize the Makespan

CPAIOR 2023 *Nice, France (May 29 – Jun 1)*
The 20th International Conference on the Integration of Constraint Programming, Artificial Intelligence, and Operations Research

- Iterated Greedy Constraint Programming for Scheduling Steelmaking Continuous Casting

APMS 2022 *Gyeongju, Korea (Sep 25 – 29)*
2022 Advances in Production Management Systems

- Rescheduling Problem for Heavy Cargo Logistics with Transporters*

CMSB 2022 *Bucharest, Romania (Sep 14 – 16)*
20th International Conference on Computational Methods in Systems Biology

- Bilevel Integer Programming Approach for Solving Control Problems on Boolean Networks*
- Computational Complexity of Trap Spaces in Boolean Networks (Poster)*

APMS 2021 (Online) *Nantes, France (Sep 5 – 9)*
2021 Advances in Production Management Systems

- An Iterated Greedy Matheuristic for Scheduling in Steelmaking-Continuous Casting Process

IFORS 2021 (Online) *Seoul, Korea (Aug 23 – 27)*
22nd Conference of the International Federation of Operational Research Societies

- Strategic Location Problem for Synchronized Last-mile Delivery with Relaying Drones*
- Workforce planning with crowdsourced logistics under regulations

INFORMS 2019 *Seattle, WA, USA (Oct 20 – 23)*
2019 INFORMS Annual Meeting

- Strategic Location Problem for Synchronized Last-mile Delivery with Relaying Drones*
- Development of Scheduling Algorithms for a Crowdsourced Delivery Persons

MSOM 2019 – SCM SIG *Singapore (Jun 30 – Jul 2)*
2019 MSOM International Conference – Supply Chain Management SIG track

- Strategic Location Problem for Synchronized Last-mile Delivery with Relaying Drones*

Conference Presentations (Domestic)

KIIE 2024 Fall *Seoul, Korea (Oct 24 – 25)*
2024 Fall Conference of Korean Institute of Industrial Engineers

- Reprogramming cell fate: A survey of control problems in Boolean networks*

KORMS & KIIE 2024 Spring *Yeosu, Korea (May 2 – 4)*
2024 Spring Joint Conference of Korean Operations Research and Management Science Society & Korean Institute of Industrial Engineers

- Proving an Approximation Ratio by Mathematical Programming
- Minimizing the Stay Time of Open Shop Scheduling Problems with the Unit Processing Time

KIIE 2023 Fall *Ulsan, Korea (Nov 2 – 3)*
2023 Fall Conference of Korean Institute of Industrial Engineers

- A Bilevel Integer Programming Approach for the Synchronous Attractor Control Problem*
- A Constraint Programming based Iterated Greedy Framework for Scheduling Steelmaking Continuous Casting Process
- Minimizing the Makespan of a Job Shop Schedule Considering Critical Paths by Deep Reinforcement Learning Based Large Neighborhood Search

KIIE & KORMS 2023 Spring *Jeju, Korea (May 31 – Jun 3)*
2023 Spring Joint Conference of Korean Institute of Industrial Engineers & Korean Operations Research and Management Science Society

- Robust fleet management in crowdsourced last-mile delivery of online retailers: the role of a mix with private vehicles*
- Computational complexity of minimal trap spaces in Boolean networks (Poster)*
- Analysis of Combining LPT and MULTIFIT Algorithms for Identical Parallel Machine Scheduling to Minimize The Makespan (Poster)
- A critical review of planning and scheduling in steel-making and continuous casting processes in the steel industry

KIIE 2022 Fall *Incheon, Korea (Nov 4 – 5)*
2022 Fall Conference of Korean Institute of Industrial Engineers

- Bilevel Integer Programming Approach for Solving Control Problems on Boolean Networks*

Seminar & Research talks

Research talk @ SKKU Business School *Seoul, Korea (Jun 18, 2025)*
SKKU Business School, Sung Kyun Kwan University

- Bilevel integer programming on a Boolean network for discovering critical genetic alterations in cancer development and therapy*

Research talk @ Kyung Hee University *Yongin, Korea (May 16, 2025)*
Department of Industrial and Management Engineering, Kyung Hee University

- Bilevel optimization: From practices to theory*

Project Experience

Research Projects (as a student)

[P1] **The Center for ALgorithms and OPtimization (CALOP)** *Jul 2024 – present*
POSTECH & Ministry of Eduction, Korea

- Program: Glocal University 30 Project
- PI: Prof. Kangbok Lee

[P2] **Theory and Practice of the Prediction of Robust Cellular Reprogramming Strategies from Logical Dynamical Models** *Oct 2023 – Sep 2025*
(Korea) National Research Foundation & Ministry of Science and ICT (MSIT)
(France) Ministry for Europe and Foreign Affairs (MEAE) & Ministry of Higher Education, Research and Innovation (MESRI)

- Program: Science and Technology Amicable Relationships (STAR)
- PI: Prof. Kangbok Lee & Dr. Loïc Paulevé (Univ. Bordeaux, CNRS, Bordeaux INP, LaBRI)

[P3] **Development of Next-generation Scheduling Framework Based on Explainable Deep Reinforcement Learning** *Mar 2023 – Feb 2027*
National Research Foundation, Korea

- Program: Mid-career Research Program
- PI: Prof. Kangbok Lee

[P4] **Developing an Optimization Framework to Improve the Performance of the Fujitsu Digital Annealer and Its Application to Solve Industrial Optimization Problems** *Jun 2023 – Jan 2024*
National Research Foundation, Korea & Fujitsu Korea Limited

- Program: Leaders in INdustry-university Cooperation 3.0 (LINC 3.0)
- PI: Prof. Kangbok Lee

[P5] **Performance Testing of Fujitsu DA (Digital Annealer) for Combinatorial Optimization and Examining Its Commercialization** *Nov 2022 – Feb 2023*
National Research Foundation, Korea & Fujitsu Korea Limited

- Program: Leaders in INdustry-university Cooperation 3.0 (LINC 3.0)
- PI: Prof. Kangbok Lee

[P6] **Algorithm Development For Gene Regulatory Network Analysis via Optimization** *Jun 2022 – May 2023*
National Research Foundation, Korea

- Program: Basic Research Program
- PI: Prof. Kangbok Lee

[P7] **Digital Logistics Platform Design Based on the Movement from Port to Port** *Apr 2021 – Nov 2022*
National IT Industry Promotion Agency, Korea

- Program: AI-based Heavy Cargo Ship Platform Demonstration
- PI: Prof. Duck-Young Kim (Department of IME, POSTECH)

[P8] **Crowdsourcing in Last-mile Delivery Considering Crowd Behavior** *Jan – Dec 2021*
Jungseok Logistics Foundation, Korea

- Program: Academic Research Support
- PI: Prof. Kangbok Lee

[P9] **Development of Cooperative Scheduling Algorithms for a Crowdsourced Logistics Platform** *Mar 2019 – Feb 2022*
National Research Foundation, Korea

- Program: Mid-career Research Program
- PI: Prof. Kangbok Lee

Industry Projects (as a student)

[P10] **POSCO Marketing Metaverse Ch/Cast Batching Optimization (Detailed Design)** *Apr 2024 – present*
POSCO DX, Korea

- Program: General R&D Project
- PI: Prof. Kangbok Lee

[P11] **Production Operations Optimization Solution Development** *Jun – Nov 2020*
LG Electronics, Korea

- Program: General R&D Project
- PI: Prof. Kangbok Lee

[P12] **Steelmaking Scheduling Considering Secondary Refinement Process** *Mar 2019 – Feb 2020*
POSCO, Korea

- Program: Joint Research on Smart Solution (JRSS)
- PI: Prof. Kangbok Lee

Teaching Experience (**UG**: Undergraduate, **G**: Graduate)

Teaching Assistant (at POSTECH)

(**UG**) Production & Operations Management *Spring 2019*
(**G**) Network Flows *Fall 2018*

Scholarship (Exchange rate: 1 USD = 1,300 KRW)

From POSTECH

- Overseas Dispatch Support Program for Graduate Students — $ 2.3K, flight tickets — *Oct 2024*
- Boeing Scholarship — $ 1.3K, living expenses — *Mar & Sep 2017*
- Honorary Scholarship — $ 0.0K, not monetary — *Mar 2017*
- Silent Love Scholarship — $ 3.8K, living expenses — *Mar & Sep 2016*
- Jigok Scholarship — $ 9.1K, full tuition — *Mar 2015 – Feb 2017*
- Work Scholarship — $ 4.0K, work-study — *Mar 2015 – Feb 2017*

Outside POSTECH

- STX Foundation Scholarship — $ 13.3K, full ride — *Mar 2017 – Aug 2018*
- POSTECH Church Scholarship — $ 0.8K, living expenses — *Jan 2017*

Awards

The Best Presenter Award *Feb 2019*
Department of Industrial and Management Engineering, POSTECH

- For the best thesis presentation among M.S. and Ph.D. candidates of the department

Academic Activities

Journal Reviewer

- Computers & Operations Research *2025 – present*
- Computers & Industrial Engineering *2024 – present*
- OR Spectrum *2023 – present*
- International Journal of Production Research *2022 – present*

Skills

Language	English (fluent), Korean (native)
Programming	Python, C, C++, Java, R, SQL, Maria DB, Qt, Graphviz
Opt. Software	Gurobi, CPLEX, Google OR-Tools, Pyomo, CVX, SCIP, CP Optimizer, Fujitsu DA
DevOps	Git, GitHub, Docker
OA & RPA	MS 365, LaTeX, Beamer, Tikz, Markdown, MS Power Automate

Coursework (at POSTECH) (**UG**: Undergraduate course, **G**: Graduate course, *: audited)

Operations Research & Management Science

(**UG**) IMEN261 Introduction to Operations Research
(**UG**) IMEN272 Probability & Statistics for Engineering
(**UG**) IMEN361 Mathematical Programming*
(**UG**) IMEN366 Probability Modeling & Analysis
(**UG**) IMEN371 Quality Engineering
(**UG**) IMEN481 Simulation
(**UG**) IMEN491J Complex Systems: Modeling and Simulation
(**G**) IMEN661 Advanced Linear Programming
(**G**) IMEN662 Discrete Optimization
(**G**) IMEN666 Applied Stochastic Processes
(**G**) IMEN763 Nonlinear Programming
(**G**) IMEN764 Dynamic Programming
(**G**) IMEN766 Queueing Theory
(**G**) IMEN862 Scheduling System
(**G**) IMEN891E Bayesian Statistics for Data Analysis

Mathematics

(**UG**) MATH110 Calculus
(**UG**) MATH113 Calculus Lab
(**UG**) MATH120 Applied Linear Algebra
(**UG**) SNU881.003 Differential Equations
(**UG**) MATH301 Modern Algebra I*
(**UG**) MATH311 Analysis I
(**UG**) MATH312 Analysis II*
(**UG**) MATH351 Introduction to Numerical Analysis
(**UG**) MATH400 Linear Algebra*
(**UG**) MATH409 Computational Linear Algebra & Applications
(**UG**) MATH461 Introduction to Combinatorics*
(**G**) MATH501 Algebra I
(**G**) MATH514 Real Analysis I
(**G**) MATH749 Application of Mathematics to Big Data

Computer Science

(**UG**) CSED101 Programming and Problem Solving
(**UG**) IMEN281 Information System Technology
(**UG**) CSED331 Algorithms*
(**UG**) IMEN382 Database Systems

(**UG**) KMOOCCSED490 Introduction to Big Data
(**G**) CSED536 Advanced Algorithms
(**G**) MATH570 Discrete and Computational Geometry

Economics & Management

(**UG**) IMEN203 Financial Accounting
(**UG**) KMOOC1726 Econometrics
(**UG**) SOSC321 Principles of Economics
(**UG**) SOSC344 Industrial & Orgranizational Psychology
(**UG**) IMEN381 Management Information Systems
(**UG**) SOSC422 Industrial Organization
(**UG**) SOSC424 Financial Economics
(**UG**) IMEN476 Production Planning & Control
(**UG**) IMEN491M Business Analytics
(**G**) EVSE680E Environmental Risk Assessment
(**G**) IMEN811S Game Theory in Business Applications

Life Science

(**UG**) LIFE103 General Life Science
(**UG**) LIFE315 Genetics*
(**G**) LIFE622Y Introduction to Synthetic Biology*
(**G**) LIFE703 Regulation of Gene Expression*

References

- **Prof. Kangbok Lee** (Ph.D. advisor)
  - *Professor, Department of Industrial and Management Engineering, POSTECH, Korea*
  - Email: kblee@postech.ac.kr
- **Prof. Michael L. Pinedo**
  - *Julius Schlesinger Professor of Operations Management, Department of Technology, Operations, and Statistics, Stern School of Business, New York University, USA*
  - Email: mlp5@stern.nyu.edu
- **Dr. Loïc Paulevé**
  - *CNRS Senior Researcher, LaBRI, Talence, France*
  - Email: loic.pauleve@labri.fr

(Last update: July 9, 2025)