

# BIOMEDICAL AND COMPUTING FRONTIERS



**Gino J. Lim**

Ph.D. – University of Wisconsin  
Professor and Chair, Industrial Engineering  
Hari and Anjali Agrawal Faculty Fellow

## Publications

1. A. Najjarbashi and G. J. Lim, "A Decomposition Algorithm for the Two-Stage Chance-Constrained Operating Room Scheduling Problem," *IEEE Access*, 8(1), pp. 80160-80172, December 2020.
2. S.J. Kim and G. Lim, "A Real-time Rerouting Method for Drone Flights under Uncertain Flight Time," *Journal of Intelligent & Robotic Systems*, vol. 100, pp. 1355-1368, December 2020.
3. M. Torabbeigi, G.J. Lim, and S.J., Kim, "Drone Delivery Scheduling Optimization Considering Payload-induced Battery Consumption Rates," *Journal of Intelligent & Robotic Systems*, 97(3), pp. 471-487, 2020.
4. Y. Wu, J. Shi, G. Lim, L. Fan, A. Molavi, "Optimal Management of Transactive Distribution Electricity Markets with Co-optimized Bidirectional Energy and Ancillary Service Exchanges," *IEEE Transactions on Smart Grid*, vol 11, issue 6, pp 4650-4661, November 2020.
5. Xuemin Bai, Gino Lim, David Grosshans, Radhe Mohan, and Wenhua Cao, "A biological effect-guided optimization approach using beam distal-edge avoidance for intensity-modulated proton therapy," *Medical Physics*, 47(9), September 2020.
6. A. Molavi, G.J. Lim, and J. Shi, "Stimulating Sustainable Development of Industrial Ports by Hybrid Economic Incentives Using Bilevel Optimization," *Applied Energy*, vol 272., #115188, August 15, 2020.
7. N. Ahmadian, G. Lim, J. Cho, and S. Bora, "A Quantitative Approach for Assessment and Improvement of Network Resilience," *Reliability Engineering and System Safety*, vol. 200, #106977, August 2020.
8. M. Najarian and G.J. Lim, "Optimizing Resilience of Cyber-Physical Systems under Budgetary Constraint," *Reliability Engineering and System Safety*, vol. 198, June 2020.
9. Y. Wu, G.J., Lim, and J. Shi, "Stability-Constrained Microgrid Operation Scheduling Incorporating Frequency Control Reserve," *IEEE Transactions on Smart Grid*, 11(2), pp 1007-10017, March 2020.

Dr. Lim is an expert in the area of large scale optimization, models under uncertainty, decomposition algorithms, and parallel computation. He is a Fellow of the Institute of Industrial and Systems Engineers and is also a recipient of other prestigious awards and honors in research, teaching, and professional service. At the Cullen College of Engineering, Dr. Lim is the Founding Director of the Systems Optimization and Computing Laboratory (SOCL). The SOCL conducts interdisciplinary research with engineers, scientists, mathematicians, and industrial representatives. The SOCL is focused on developing robust mathematical models, computational algorithms, and related software to make significant contributions to industry while maintaining high quality academic research. Selected projects undertaken by Dr. Lim's laboratory include robust optimization in radiation treatment planning, evacuation planning and response, resilient power systems design and fast power restoration, and optimal routing of drones for healthcare delivery and security surveillance.

## RESILIENCY AND SUSTAINABILITY

Adverse events such as natural disasters (e.g., earthquake, tropical cyclone, severe storm, flooding, freeze, wildfire, winter storm, etc.) or man-made disasters (terrorist and non-terrorist) can disrupt community infrastructures. From 1980 to 2011, more than 130 extreme events resulted in close to \$1 trillion in damages in the United States. Hence, building resilient communities is crucial for our well-being and prosperity. A resilient system is capable of absorbing continuous and unpredictable changes, while maintaining its vital functions. Dr. Lim's research team has developed a unified quantitative approach to comprehensively describe the network resilience status by combining many aspects of resilience. The concept has been successfully implemented in various applications such as electric power restoration, maritime port management, evacuation planning and management, and smart border surveillance.



## OPTIMIZATION IN HEALTHCARE SYSTEMS ENGINEERING

Healthcare systems are very complex. Our team of researchers focus on developing practically useful optimization models and computational algorithms to help hospitals and other healthcare organizations optimize their resource utilization, conduct expansion planning, and undertake medical decision making. We have been actively collaborating with local medical centers such as MD Ander-

**Publications (Continued)**

10. Y. Wu, M. Barati, and G.J. Lim, "A Pool Strategy of Microgrid in Power Distribution Electricity Market," *IEEE Transactions on Power Systems*, 35(1), pp 3-12, January 2020.

11. A. Molavi, J. Shi, Y. Wu, and G.J. Lim, "Enabling Smart Ports Through the Integration of Microgrids," *Applied Energy*, vol 258, 114022, January 2020.

12. G.J. Lim, L. Kardar, S. Ebrahimi, and W. Cao, "A Risk-based Modeling Approach for Radiation Therapy Treatment Planning under Tumor Shrinkage Uncertainty," *European Journal of Operational Research*, 280(1), pp266-278, January 2020.

son Cancer Center to develop optimal plans for treating cancer patients, scheduling operating room cases and personnel. We have recently expanded our areas of research to help improve health disparity among rural patients based on the concept of Helehealth-home heathcare.

**EMERGING TECHNOLOGIES – DRONES**

The SOCL research team has been developing optimal scheduling methods for routing drones. Chronic diseases are a significant concern and are an overwhelming component of overall healthcare expenses. To deliver medical kits to rural patients in an effort to improve healthcare disparity, Dr. Lim's research team has developed an innovative drone-aided healthcare delivery and pickup services.

The U.S. Customs and Border Protection (CBP) plays an important part in securing and protecting the United States. However, it is impossible for CBP to detect, secure, monitor, and patrol tens of thousands of miles of land borders and shorelines by law enforcement agents due to harsh environments along the border areas coupled with insufficient budgets. To address this concern, Dr. Lim's research team has developed a drone-aided border surveillance system with electrification line battery charging systems.

