Statement of Purpose

Renlong Wang PhD Program in Construction Engineering and Management

My name is Renlong Wang, and I am writing to express my strong enthusiasm for pursuing a PhD degree in Construction Engineering and Management. My current research experiences center on developing quantitative methodologies for modeling, evaluating, and optimizing complex systems under uncertainty based on advanced techniques of system simulation, operations research, and network analysis. These experiences have deepened my commitment to advancing the field by advancing methodologies for resource-constrained project scheduling under uncertainty.

Practical Innovation thourgh Undergraduate Experiences.

I earned a bachelor's degree in Civil Engineering from Nanjing Tech University, where I received comprehensive training through a demanding curriculum. During this period, I engaged in several innovation projects focused on complex system modeling and analysis, particularly in prefabricated construction safety and infrastructure resilience. These experiences helped me develop skills in multi-attribute decision analysis, discrete-event simulation, and optimization modeling. As my research progressed, I faced challenges that drove me to improve my ability to translate real-world operational problems into mathematical models. To this end, I actively participated in mathematical modeling competitions, earning top honors such as the Outstanding Winner Prize and Society for Industrial and Applied Mathematics (SIAM) Award in the American Undergraduate Mathematical Contest in Modeling, as well as the First Prize in the Contemporary Undergraduate Mathematical Contest in Modeling. These accomplishments enriched my research and sharpened my ability to connect abstract modeling techniques with practical challenges. A representative example is my work on an enhanced cellular automata–based framework for simulating the resilience of hospital Power-Water-Firefighting-Space (PWFS) systems, published in *Simulation Modelling Practice and Theory*. The model integrates component-level behaviors with system-level interdependencies and simulates cascading failures, resource allocation, and recovery under uncertain disruptions, such as demand surges during COVID-19. This research strengthened my ability to translate complex, uncertain, and resource-constrained real-world systems into computational models—skills directly applicable to designing optimization and scheduling methods for projects under uncertainty. Recognized for my academic performance, I was honored as a Distinguished Graduate of Jiangsu Province in Civil Engineering. Together, these experiences provided practical insights and a rigorous first-principles approach, preparing me for advanced research in complex system modeling and optimization under uncertainty.

Mathematical Skills via Postgraduate Training.

My undergraduate research experience made me deeply aware of the pivotal role mathematics plays in solving complex engineering and operational problems, motivating me to pursue a master's degree in Industrial Engineering and Management at University of Chinese Academy of Sciences. There, I strengthened my mathematical foundation

through advanced coursework, including *Operations Research*, *Stochastic Operations Research*, *Applied Statistics*, and the PhD-level course *Optimization: Model, Theory, and Algorithm*. Building on this foundation, I conducted research on optimization-based decision analysis by integrating advanced paradigms of decision-making under uncertainty, such as robust optimization, stochastic programming, and distributionally robust optimization. Additionally, I addressed key issues like multi-criteria trade-offs and resource allocation constraints, which serve as a natural bridge connecting my theoretical knowledge in mathematics with practical scheduling and operational challenges. I actively engaged in academic forums, delivering presentations and sharing research outcomes, which earned me multiple awards for excellent papers. Related research outcomes have been published in prestigious journals, such as *Expert Systems with Applications*, *Information Sciences*, and *Energy*. My efforts were recognized with *the Excellent Prize for the President Scholarship of the Chinese Academy of Sciences* (2025, Top 1%) and *the National Scholarship for Postgraduates (Master)* (2024, Top 1%). This stage of my training not only consolidated my mathematical and optimization skills but also cultivated a rigorous research mindset and effective communication abilities, laying a solid foundation for advancing research on resource-constrained project scheduling under uncertainty.

Research Interests and Career Goals.

My research interests center on resource-constrained project scheduling under uncertainty, particularly through mathematically sound optimization models and efficient scheduling strategies for complex projects. Building on my prior research in optimization-based decision-making and complex system modeling, I aim to view project performance not only in terms of timely completion but as an emergent property shaped by resource availability, task interdependencies, and stochastic disturbances. Specifically, I plan to model scheduling decisions under uncertain task durations and resource constraints by integrating simulation-based methods with probabilistic and robust optimization frameworks, using tools such as reinforcement learning, stochastic programming, and distributionally robust optimization. I am also interested in contextual optimization—leveraging side information to better predict uncertainty distributions—and in jointly optimizing resource allocation and scheduling policies. Beyond technical modeling, I am motivated by the prospect of bridging theory with practice, developing decision frameworks that are both computationally tractable and implementable for project management and operations. Overall, I aim to advance from modeling analytics to predictive analytics and ultimately to prescriptive analytics—combining simulation, machine learning, and operations research—to establish a comprehensive paradigm in which these approaches function synergistically rather than in isolation. In the long term, I aspire to pursue an academic career that contributes both theoretically and practically to project scheduling under uncertainty. My goal is to develop widely applicable methodologies that not only advance the theory of decision-making under uncertainty but also inform practical project planning, ultimately enabling organizations to execute complex projects more efficiently and resiliently despite stochastic disruptions.