Gang Li

gang.li@usask.ca   Saskatoon, SK, Canada   gangli-engineering.com

Education

Ph.D. Civil Engineering
University of Saskatchewan, Saskatoon, SK, Canada   2023
- Dissertation: *"Modelling of Cracked Reinforced Concrete Corrosion in Service Environments"*

M.Sc. Civil Engineering
University of Saskatchewan, Saskatoon, SK, Canada   2014
- Thesis: *"Effect of Cracks on the Transport Characteristics of Cracked Concrete"*

B.Eng. Materials Science and Engineering
Chongqing University, Chongqing, China   2008
- Specialized in civil engineering materials

Professional Associations

Registered Professional Engineer (P.Eng.)
Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS)

Professional Experience

Research Associate
Corrosion and Electrochemical Engineering, University of Saskatchewan   Saskatoon, SK, Canada
Jan 2024 – Present
Project: *Electrochemical evaluation of iron-based alloys corrosion and protection for potash mining environments*
Partnership: Nutrien
- Led an electrochemical study on corrosion processes in potash mining, focusing on anodic and cathodic behaviours of iron-based alloys. Enhanced quantitative corrosion prediction, aiding strategic material selection and improving sustainability of mining assets.

Mitacs Accelerate R&D Engineer
University of Saskatchewan and various partnerships   Saskatoon, SK, Canada
Sep 2020 – Dec 2023
Projects:

- *Effective concrete mixes for Saskatchewan sidewalks using locally available pop-out prone aggregates*
  Partnership: City of Saskatoon
  - Developed cost-effective remedial strategies for reducing, and possibly eliminating, pop-out damage to concrete sidewalks, as well as other potential forms of damage caused by freeze and thaw cycles and ASR.

- *A non-destructive approach for assessing the integrity and performance of waterproofing membranes in bridge decks*
  Partnership: ZACARUK consulting Inc
  - Developed a non-destructive method for assessing the integrity of waterproofing systems in reinforced concrete bridge decks. The proposed technique is used to assess the quality of a newly installed membrane system, or to determine whether the membrane is deteriorating during its service life.

- *A rational data-driven probabilistic approach for assessing the condition and performance of RC structures*
  Partnership: ZACARUK consulting Inc

- Developed life-cycle deterioration model software for predicting the service condition of reinforced concrete structures using field data. The software employs probabilistic analysis to optimize maintenance and repair strategies, significantly extending asset lifespan. Applied to Moose Jaw Inland Grain Terminal and Petrofka Bridge, enhancing maintenance scheduling and structural health monitoring.

Consultant
ZACARUK consulting Inc   Moose Jaw, SK, Canada
Aug 2019 – Dec 2019
- Designed a moisture monitoring system for concrete silos, provided personnel training for the installation and operation of the system. Assessed the carbonation-induced corrosion conditions using collected field moisture content data.

Research Engineer (full-time & part-time)
University of Saskatchewan, City of Saskatoon   Saskatoon, SK, Canada
May 2014 – Sep 2015 & Sep 2015 – Apr 2018
Project: *Bridge arch repair and life-cycle cost assessment*
- Developed and implemented advanced corrosion monitoring systems for a reinforced concrete arch bridge, focusing on moisture, conductivity, and oxygen levels. Conducted detailed analyses of concrete pore solutions to evaluate rebar corrosion behaviours under various environmental conditions. Designed a transport model to project corrosion scenarios influenced by diverse conditions and climate change. Optimized rehabilitation strategies to enhance lifecycle cost-efficiency. Led test panel validation, managed construction projects, and coordinated multi-party collaborations to ensure cohesive rehabilitation treatments.

Programming and Software Development

Programming Experience:

- Python: Advanced expertise in data science (Pandas, Matplotlib), machine learning (Scikit-Learn, TensorFlow), and advanced computational techniques including probabilistic and numerical modelling. Proficient in object-oriented programming.

- COMSOL Multiphysics & MATLAB: Specialised in modelling reactive chemical transport in porous media, electrochemistry, and material mechanics. Highly skilled in conducting large-scale simulations on high-performance computing clusters.

Developed Software:

- Li, G. (2024). Reference Electrode Potential Converter (v0.0). Zenodo. https://doi.org/10.5281/zenodo.10937502. Web app.

- Li, G. (2022). Rational-RC: a practical life cycle deterioration modelling framework for reinforced concrete structures. Version v0.2.3. (Documentation).

- Li, G. (2021). Ground Penetrating Radar Line Scan Data Visualization and Measurement. Web app.

- Li, G, Evitts, R, & Boulfiza, M. (2018). Homogenized-model-simplified-circuit: code for "the simplified circuit model" (v1.0.0). 2019 NACE Northern Area Western Conference (NACE NAWC 2019). Zenodo. https://doi.org/10.5281/zenodo.1406210.

- Li, G., Evitts, R., Boulfiza, M., & Li, A. (2018). A customized Python module for interactive curve fitting on potentiodynamic scan data (Version v1.0.2). Zenodo. https://doi.org/10.5281/zenodo.1406195.

Publications

Journal Papers

6. Li, G., Boulfiza, M., & Evitts, R. (2024). On the subtilities of rebar corrosion behaviour in cracked concrete. (under review with *Cement and Concrete Composites*)

5. Li, G., Evitts, R., & Boulfiza, M. (2024). Interactive effects of moisture, chloride, and carbonation on rebar corrosion in mortar. *Construction and Building Materials*, 440, 137440. https://doi.org/10.1016/j.conbuildmat.2024.137440

4. Li, G., Boulfiza, M., & Evitts, R. (2024). A 3-D transport model for assessing the impact of microclimate change on the corrosion performance of a bridge subjected to carbonation and chloride attack. *Case Studies in Construction Materials*, e02880. https://doi.org/10.1016/j.cscm.2024.e02880.

3. Li, G., Evitts, R., & Boulfiza, M. (2023). On the corrosion parameters acquired through potentiodynamic scans of carbon steel rebar in simulated pore solution and mortar. *Construction and Building Materials*, 409, 134160. https://doi.org/10.1016/j.conbuildmat.2023.134160.

2. Li, G., Evitts, R., & Boulfiza, M. (2023). Dataset of corrosion parameters for rebar in simulated pore solution and mortar (v1.0.1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.10150202.

1. Li, G., Evitts, R., & Boulfiza, M. (2023). The impact of non-uniformity and resistivity on the homogenised corrosion parameters of rebars in concrete–a circuit model analysis. *Corrosion Engineering, Science and Technology*, 58(4), 399-409.

Conference Papers

4. Li, G., Boulfiza, M., & Evitts, R. (2019, February). Corrosion Prediction with 3D Model Utilizing Meteorological Data and Properties of Site-extracted Rebar and Concrete. Proceedings of *NACE Northern Area Western Conference*. Calgary, AB, Canada.

3. Li, G., Boulfiza, M., & Si, B. (2015). Effect of artificial and natural cracks on water flow in concrete. Proceedings of the *5th International Conference on Construction Materials*. Whistler, Canada.

2. Kennell, G., Zacaruk, J., Li, G., & Boulfiza, M. (2015). The University Bridge Arch Assessment–A New Approach. In *TAC 2015: Getting You There Safely–2015 Conference and Exhibition of the Transportation Association of Canada*.

1. Li, G., & Boulfiza, M. (2013). Effects of cracking on the transport characteristics of reinforced concrete. Proceedings of the *24th Canadian Congress of Applied Mechanics*. Saskatoon, SK, Canada.

Patent

Li, G., Boulfiza, M. A Non-Destructive Approach for Assessing the Integrity and Performance of Waterproofing Membranes in Bridge Decks. United States Provisional Application No: 63/644,703, filed May 17, 2024, pending.

Teaching Experience

Sessional Lecturer
University of Saskatchewan, Saskatoon, SK, Canada   Sep 2019 – Dec 2019 & Sep 2022 – Present
Department of Chemical & Biological Engineering
CHE 453 Corrosion Engineering
- Redesigned and delivered the course, integrating theoretical concepts with real-world applications through diverse instructional methods, including interactive case studies and tailored web apps. Developed assessment tasks reflecting professional engineering challenges.

Department of Civil, Geological and Environmental Engineering
CE 212 Civil Engineering Materials
- Delivered content on the properties, testing, and sustainable use of materials in civil engineering. Emphasized practical applications through lab sessions, case studies on significant projects.

Department of Computer Science
CMPT 141 Introduction to Computer Science

- Focused on building foundational programming skills through extensive coding exercises, adaptive grading systems, and interactive learning tools. Implemented comprehensive feedback mechanisms to enhance student learning and reduce exam anxiety.

Adjunct Faculty Member
St. Peter's College, U of S first-year engineering program   Muenster, SK, Canada
CMPT 142 Introduction to Computer Science for Engineers
Sep 2022 – Present
- Adapted course content to enhance the immersive learning experience of a small-sized class. Utilized formative assessments to provide immediate feedback. Adjusted instructional methods to accommodate diverse skill levels.

Teaching Assistant
University of Saskatchewan   Saskatoon, SK, Canada
2009 – 2014 (various terms)

- Material testing lab – *CE 212 Civil Engineering Materials*

- Problem solving lab – *CE 318 Applied Engineering Mathematics*

- Structural analysis software tutorial lab – *CE 463 Advanced Structural Analysis*

Certificates and Awards

- 2024 Certificate in University Teaching and Learning, The Gwenna Moss Centre, University of Saskatchewan

- 2024 Nomination for PhD Thesis Awards, University of Saskatchewan

- 2021 Certificate of Project Management, Mitacs

- 2020 Certificate of Applied Machine Learning in Python, University of Michigan (via Coursera)

- 2020 Certificate of Contribution, NACE Calgary Sector

- 2016 Saskatchewan Innovation and Opportunity Scholarship, Government of Saskatchewan

Professional Engagements and Presentations

Presentations:

- Ministry of Highways and Infrastructure Web Conference   Jul 30, 2020
  Deterioration of structures: testing and rehabilitation

- NACE Northern Area Western Conference (Regina, Canada)   Feb 6, 2020
  Homgeniszd corrosion parameters of rebars in concrete

- NACE Northern Area Western Conference (Calgary, Canada)   Feb 7, 2019
  Corrosion Prediction with 3D Model Utilizing Meteorological Data and Properties of Site-extracted Rebar and Concrete

Invited Talks:

- College of Materials Science and Engineering, Tongji University (Shanghai, China)   Jul 31, 2024
  Modelling of cracked reinforced concrete corrosion

- Saskatoon Engineering Society (Saskatoon, Canada)   Nov 29, 2019
  Corrosion Arch Rehab for the University Bridge

- NACE Calgary Luncheon Technical Session   Jan 25, 2019
  Computer-aided Assessment of Arch Rehabilitation Strategies for the University Bridge

Media Engagements:

- Interview on Global News　　　　　　　　　　　　　　　　　　　　　　Jan 8, 2019
  Topic: *Calcium chloride and its corrosive effects on concrete and asphalt*

- Live Interview on 630CHED Radio *Ryan Jespersen Show*　　　　　　　Aug 22, 2018
  Podcast: *Corrosion & the maintenance needs of civic structures* (Duration 20:40)