Microwave-based ice-detection system for cable-supported bridges

A considerable segment of the globe experiences cold-weather conditions accompanied by the accumulation of seasonal snow and ice formation. Icing can lead to significant challenges in various industries, including aerospace, renewable energy, energy transmission, and cable-supported bridges, where the formation of ice can affect the structural dynamics and performance of components. Accreted ice on cable-supported bridges can fall onto roadways and pedestrian pathways, causing severe damage and endangering the safety of people and vehicles. More than 1,300 people die every year in icing-related incidents, and an estimated $2.3 billion is spent annually on snow and ice control operations, with the vital objective of real-time icing monitoring for increased safety and optimized performance.

Although various optical and electrical sensing mechanisms have been developed to detect ice accumulation in real-time, microwave-based sensors have recently gained attention in sensing and detection applications due to their flexibility, durability, low cost, and high sensitivity. Microwave-based sensors offer a promising approach for wireless ice sensing and detection.

The goal of this project is to develop a microwave-based ice sensing system for early and efficient detection of bridge-cable icing to ensure drivers' and passengers' safety in icing events. This realtime ice detection system will prevent unnecessary interruption to traffic flow and decrease the risks and costs to operating companies. To accomplish this goal, the research will involve designing and fabricating flexible microwave sensors that accurately differentiate between air, dust, water, and ice accretion. Furthermore, the ice detection system will be integrated with readout electronic circuits for data processing and acquisition.

The project is expected to begin in 2023 and end in 2027. The project will be led by the Senior VP, Project Director Don Bergman from COWI North America Ltd. (Department 5762 Operations, North)**,** and Associate Professor and Principals Research Chair Mohammad Zarifi from the University of British Columbia (UBC). The Ph.D. student, Fatemeh Niknahad, from UBC's School of Engineering, will be actively involved in the project, conducting research and experiments to fulfill the research objectives.