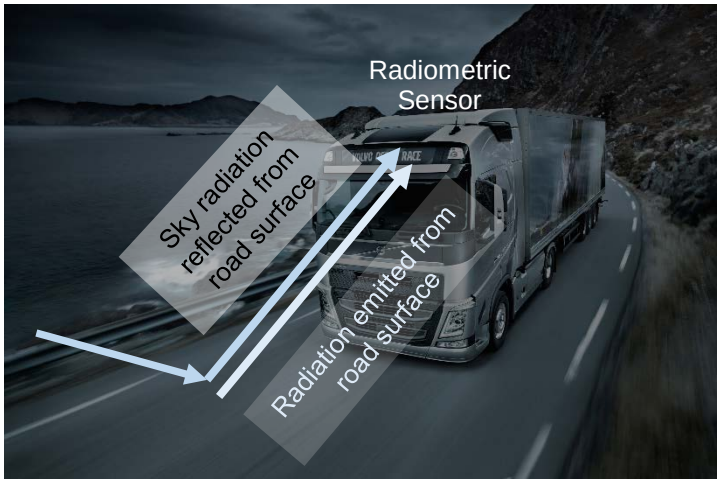
Early detection of ice formations in traffic conditions

Background

Icy roads are one of the top causes of weather induced road accidents. The most dangerous ice formation is the so called “Black Ice”, a thin sheet of ice, which is virtually transparent and nearly invisible. While snow is clearly visible for a driver, detecting black ice formations is a challenge. Available technologies for would not work for sensing in front of a moving car since active illumination originating from the vehicle would produce no backscatter due to the specular nature of the black ice or water.



Information about the project:

We want to verify a new method for road surface identification, which takes advantage of the frontal “natural” illumination provided by the cold sky, which is reflected by the road surface at frequencies around 80 GHz. This method can be very useful when a patch of ice is located in front of a moving car and is detected before the wheels become in contact with the ice. The surface recognition is possible due to the fact that water and ice have different dielectric constants. In addition they represent specular surfaces, which makes reflected radiation polarized. Measuring the surface temperature at two orthogonal polarizations gives the possibility to measure the level of polarization and better distinguish water or ice covered surface from dry surfaces.

To measure the radio temperature of the surface we are going to construct a Radiometer instrument, a sensitive receiver that measures the combination of emitted and reflected (from the sky) thermal radiation from the surface. The receiver will cover frequencies between 80 GHz to 100 GHz and will include low-noise amplifier, a mixer, an intermediate (IF) amplifier and local oscillator (LO) generation.

About us

At the microwave electronics laboratory, department of microtechnology and nanoscience (MC2), we perform research in developing integrated circuits and systems for frequencies of up to 400 GHz. We have successfully developed radio frequency (RF) integrated microwave circuits (MMIC), components and systems for applications in security imaging, high data rate communications and monitoring of industrial processes. We are looking forward to expanding the areas of applications of our research – traffic safety is a new area where we believe we can contribute.

Major responsibility:

Modeling of brightness temperature of layered structures of different composition roughness and thicknesses. Experimental work on verification of the detectability of different surfaces and thicknesses.

Qualifications

We are looking for one or two students with interest in electrical engineering and/or remote sensing. Background in microwave, mm-wave technology is essential for the project.

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