Advances in the use of Ground Based Radar for Disaster Recovery Risk Management

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SUMMARY

At the beginning of the 20th century, radio waves were first used to detect the presence of objects but it was not until the 1940's that radar, an acronym for RAdio Detection And Ranging, was used routinely for detecting the presence of aircraft and naval ships. Radar now has a broad range of highly diverse applications including air traffic control, astronomy, air-defence systems, speed calculation, navigation (air, sea and space), collision avoidance, surveillance and meteorology.

More recent uses of ground based radar include ground-penetrating radar (GPR) for geological and civil infrastructure investigations, and interferometry and synthetic aperture radar for remote monitoring of the movement of structures and landscapes. The use of ground based radar therefore lends itself to applications in disaster recovery risk management.

For example, GPR is now used routinely to determine railway ballast, road pavement and concrete substructure condition but can also be used to determine the extent of damage to this infrastructure after flood events, cyclones or earthquakes. Other novel applications of GPR is it's use for real time detection of people trapped under rubble and to determine if there is movement.

Interferometric radar is used to detect sub-millimetre movement and provide vibration analysis of civil infrastructure, such as bridges, buildings, tunnels, and dam walls and therefore can determine whether these structures are performing according to their design specifications both during and after disaster events. It can also be used to monitor active volcanic cones to determine whether they are inflating prior to eruption. Other systems combine interferometry and synthetic aperture radar to monitor slope movement for landslide prediction and also to measure land subsidence after earthquake activity.

Frequency Modulated Continuous Wave (FMCW) radar is also used to detect obstacles blocking track at level crossings, overpasses and tunnel entrances and exits. Their primary aim is to ensure collision avoidance in high risk zones and they can provide real time alarming and video feeds to control centres to continuously monitor these zones. Again, this type of system lends potentially itself to monitoring infrastructure immediately following natural disasters.

This paper looks at recent innovations in ground based radar technology and potential applications to disaster recovery risk management.