Members: Mengru Wang **University:** University of Birmingham

RA7 **Transport Infrastructure**

Key Characteristics: High-speed: Potential to be integrated into passenger vehicles operating at line speeds • Cost-effective: Automated inspection with minimum personnel involvement • Reliable: Real-time defect identification, take further action after the detection of irregularities •

Automated In-service Inspection of Rail Infrastructure

Reliable and cost-effective inspection of rail infrastructure is of vital importance to ensure the safety of railway system operations.

Current inspection techniques are often based on manual devices operated by trained personnel at walking pace, or purpose-built inspection vehicles operating at 30-50 km/h.

In a market where speed and cost are of great importance, systems which require frequent out-of-hour maintenance activities do not fulfil the future requirements of the rail industry. Hence, a novel inspection system with the potential to be integrated into passenger vehicles operating at line speeds is proposed.

The idea is to monitor the condition of railway infrastructure while in service; so that further offline inspections will not be required until irregularities have been detected. The initial proposal is a high-speed railhead inspection system using Rayleigh-wave EMATs. The results are processed and produced by field programmable gate arrays (FPGA) in real-time. Due to the EMAT's sensitivity to lift-off, an electronically controlled actuator has been implemented to maintain the transducer-to-rail distance within a specified tolerance. Preliminary calculations, laboratory and field test results have demonstrated that the designed system could effectively identify developing railhead surface cracks of less than 5 mm with the potential to operate at a speed of up to 100 km/h.

At the moment, the speed of the system is limited by the performance of the actuator implemented. Additionally, the effect of speed on the performance of EMAT sensors has not yet been studied in detail. These will be the focus of further development work in order to move towards line speed inspection •