

Robotic tunnel inspection and repair

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ABSTRACT

Inspections are part of tunnel operation. To assure users safety periodic inspections of the state of the tunnels lining are needed. Current tools available have one problem in common: they cause severe interference with the tunnels regular operation. In order to avoid this issue, these inspections must be done in short periods of time and trying not to interrupte traffic, therefore usually at night. The DRAGARITA robot has been designed as a versatile remote controlled vehicle which is able to move in horizontal, vertical and inverted surfaces. It has been developed to reach inaccessible zones and to perform a fast inspection through cameras and scanners.

An inspection can determine the need of a **repair**. Concrete structures in their different applications and, in particular, in tunnels are subjected to deterioration during their cycle life. After a survey to diagnosis the deterioration mechanisms that affects structure, an appropriate repair strategy can be decided. IRIS is an innovative alternative to manual procedures for the application of carbon fiber and resin injection in concrete surfaces during tunnel maintenance. It is based on a special designed light-weight integrated tool used for automatic application of Fiber Reinforced Polymer (FRP) and epoxy resin injections.

23.1 INTRODUCTION

Nowadays tunnels are designed and built to last hundreds of years. However its life cycle can be reduced to tenth by change of use, new loads criterions and, impact and damage caused by natural or human factors.

The robot design is oriented for tunnel inspection but its capabilities can be extended to many other fields for inspection of different structures where inspection represents a risk for personnel.

Thanks to the equipment mounted on the robot, clear images and data of the surface can be received; this data can be stored for analysis and report purposes. The lighting and positioning systems the vehicle is equipped with facilitate its operation in dark environments without any problem.

The IRIS robot is definitively the first system of its kind, it has set a precedent for any robotic tunnel inspection and maintenance system of the future. It has been developed for inspection, maintenance, and reparation of small cracks and weakened surfaces. This fulfils the philosophy of true preventive maintenance. Reparation of small cracks beforehand will prevent the evolution of these small cracks into great, steep ones.

Just as well, reinforcement of weakened structures will prevent action effects that can cause the deterioration of the rest of the tunnel's infrastructure. Main characteristics of the robot system include reduction of operation times, a quick system and HMI learning curve, and a global increase of commodity and productivity for the operator and society. Operation can be achieved, risk free, without need of stopping traffic flow or mounting colossal scaffolds.

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