

# An Application of Bragg grating array to measure real-time scour depth at river bridges

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## Summary

The paper presents an innovative method to measure real-time scour depths around river bridge structures under both ordinary and flood conditions. The new approach adopts an array of temperature sensors based on optical fiber technology (Fiber Bragg Grating), located close to the immersed structure. Experimental laboratory tests are presented and results discussed, demonstrating the performance of the system in a variety of possible geometrical and flow conditions. Small-scale results are extremely encouraging with respect to the possibility of applying the technology to field cases.

**Keywords:** Structural monitoring, risk management, bridge scour.

## 1. Introduction

Scour around bridge piers is one of the major causes for bridge failure ([1] and [2]). Scour rates and maximum depths highly vary with the characteristics of the system and the flow intensity; high stage conditions are typically, though not necessarily, most critical for the stability of the structure.

Unfortunately, models for accurate and robust predictions of scour levels are presently not available: this knowledge limitation can be overcome by means of large safety factor while designing new structures; on the contrary, vulnerability and risk assessment for existing bridges based on pure modelling are often not achievable. In such conditions, real time monitoring of scour depths appears as the only possibility to reduce uncertainties in risk evaluations during flood events which, on turn, allows proper decisions about the necessity of interrupting the circulation along the bridge.

Real time monitoring of scour depths is a crucial tool to reduce uncertainties in risk evaluations during flood events. In spite of a relatively wide variety of possible technologies, no one can be considered to be a consolidated standard, as all methods (among them, echo sounders) present significant drawbacks, particularly during flood conditions [3].

Presentation of the new device includes technical information about the instrument and the technology used. Moreover some laboratory tests are shown and discussed to evaluate the effectiveness and reliability of the technique.