



Laboratory investigation on the applicability of an interferometric fibre-optic sensing system for monitoring of shallow soil mass movements

Vladislav Ivanov (1), Laura Longoni (1), Davide Brambilla (1), Maddalena Ferrario (2), Marco Brunero (2), and Monica Papini (1)

(1) Politecnico di Milano, DICA, Italy, (2) Politecnico di Milano, DEIB, Italy

Fibre-optic (FO) sensors are on the verge of becoming a widely adopted technology, even in fields which are scarcely related to the technology itself. Hydrogeological hazard monitoring and mitigation has been profiting from the development and implementation of various fibre-optic based tools, used as an alternative to conventional monitoring devices. This research field unveils a great potential for such systems to be implemented and therefore the subject merits further investigations, especially in the applicability to monitor soil mass movements of significant dimensions and at remote locations. Initial steps for the validation of optical fibre based sensor applicability could certainly benefit from laboratory experimentation in order to determine best practices before taking it to the next level of field application. In this work we present a series of laboratory experiments aimed at the validation of an innovative FO based sensor as a landslide monitoring tool. Experimental procedure involves the simulation of the development of shallow mass movement in an instrumented channel. The sensing/interrogation system employs an interferometric architecture with a coherent detection scheme and thus allows for the efficient detection of strain at a broad range of sampling frequencies. On the other hand, the design of the sensing unit and its placement permits the measurement of both direct physical deformation as well as the impact of high-frequency elastic waves. Results indicate the ability of the system to detect instability signals which, in some cases, are well before any other signal of failure. Detection of emissions released from the internal grain friction are found particularly interesting result. The monitoring system could thus be exported to various applications within the landslide stability monitoring field. Further works involve the installation of the system at a designated site which hosts numerous cases of shallow landslides.