

**ADVANCED TECHNOLOGIES IN A LANDSLIDE MONITORING SYSTEMS.  
APPLICATION OF THE ROBOTIZED INCLINOMETER SYSTEM  
IN LANDSLIDE AREAS**

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Monitoring systems are a very important element for the study of geo-hydrological problems and in the field of engineering geology. Hardware and software technology innovations over the last years have improved the features of the systems for the point of view of the algorithms, complexity, accuracy and costs. The application of advanced technologies joined at new investigation techniques allow continuous and remote controls on parameters involved in the evolution of the slope instability phenomena or in the geo-engineering problems.

In this field, the Geohazard Monitoring Group (GMG) of IRPI-CNR have developed and patented a new instrumentation to measure the deep-seated ground deformations using an inclinometer probe in a robotized system. Inclinometer measurements are widely used for monitoring of landslides, retaining walls, piles and in all geo-engineering contexts where is necessary to measure deep-seated ground behavior (landslide or other geo-engineering process). This instrumentation combines the advantages of the traditional measurements with a robotized approach that increase the results in term of revisit time, repeatability and accuracy. The AIS (Automated Inclinometer System) allow to explore automatically the complete length the borehole and can, sometimes, be used as an alternative to in place inclinometers or in combination with them.

This system was used in the last years in several landslide areas in Europe on boreholes until 120 meters depth with interesting results. With a daily (or more) measurements has been possible to investigate the relationships between deep displacements, rainfalls, snowmelt for landslide characterization but also to analyze the triggering factors.

A critical review on the monitoring approach, instrumentation and technologies used will be carried out through some case studies in Apennine and Alpine area (Italy and Swiss) and in the Pyrenees Mountains.