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Conceptualization of an anti-erosion sensing revetment for levee monitoring: experimental tests and numerical modelling

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Smart levees represent a revolution in the field of embankment monitoring and safety during flood events. A smart levee, intended as the native (or “from scratch”) integration of an engineering structure with sensors and connection systems, provides detailed information on its past, current and future conditions Viz. integrity stress/strain conditions, maintenance state. This gives decision support to the figures in charge for maintenance and surveillance of the embankments, increasing efficiency and, particularly, the degree of protection from flood events. Sensor information can also be mashed up with other information, such as water stage, rainfall, soil wetness offering an useful integrated view of the river context.

We present here first results of a research project concerning the conceptualization of a sensing anti-erosion revetment for embankments, through the integration of a double-twisted steel wire mesh with an optic fiber cable. The fiber is woven into the double-twisted sections and is capable to detect the nearly continuous deformation of the meshes caused by stresses exerted in its plane. The sensor sensitivity is enough to record deformation due to (small) shear stresses exerted by eventual overtopping flows, though it can bear (and report) huge deformations typical of quite higher stresses up to thousands of microstrain.

Several cycles of experiments, jointly with numerical modelling, clearly show the feasibility of such a product line, also showing a good linearity of the smart revetment behavior.