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River Hydraulics, lagoon and biofluidodinamica laboratory

The laboratory operates as a research and testing facility in the industry of Hydraulics and Hydraulic Engineering; it also supports educational activities as part of the teachings of study courses or related to undergraduate and doctoral theses. Moreover, it's used to do experimental research and surveys commissioned by public institutions and developed within national and international research projects. In the laboratory different physical models to support research activities are placed.

- **Experimental studies on the dynamics of bed forms in sandy natural streams**, in particular considering the roughness that mobile bed offers to the flow and behavior of the bottom forms during a sediment supply variation. The experiments are conducted using a rectangular straight channel that has variable slope, with a sediment supply at its beginning.
- **Hydraulic Danger caused by collapsing embankment**, with particular reference to the study of the hydrodynamic mechanisms that are established in the course of water when an embankment failure happens. The experiments are conducted in a 5 m long straight tilting hydraulic channel, 0.44 m wide and 0.35 m deep. Through the depth of the flow measurements, speed profiles and streamlines the flow field is reconstructed in the neighborhood of the breach.
- **Hydraulic risk due to accumulation of arboreal debris at bridge piers**, whose experimental activity conducted on the same channel of the previous experiments, aims to investigate the effects of the shape of bridge pile on the accumulation of arboreal debris. In particular, the arboreal debris were reproduced through cylindrical sticks of beech wood try of branches and roots, dividing them into three different classes of lengths and diameters in relation to the width of the channel, while five different forms of the stack have been reproduced using a 3D printer with 30% thermoplastic filler material. The tests were conducted in conditions of subcritical flow (Fr <1).
- **Lagoon morphodynamic**, with particular reference to the morphodynamics evolution of the lagoon borders. The experimental activity is conducted through the use of a 50 m long, 0.8 m wide and high maritime channel, in which it is possible to simulate the variation of the water level due to the tide and the waves incident on the probe. At one extreme it's placed a device for the generation of the wave motion and resistive probes are located in different positions for the measurement of the variation of the free surface with respect to a quiet

level. On the physical model of the bank some sensors are inserted for the pore pressure measurement and for the volumetric water content.

- **Bio-fluid-dynamic**, with particular reference to the lower urinary tract, a physical model has been designed and built to study the main relationships between the hydrodynamic variables. The physical model is constituted by a 2 m height cylindrical tank (which represents the bladder) with a drain hole on the bottom connected to a 20 cm length elastic collapsible latex Penrose drain type tube (urethra) with 6 mm inner diameter at rest. The elastic compression on the urethra due to internal organs was simulated by placing the elastic tube between two 30x20x5 cm^3 foam blocks under compression. Despite the simplified structure, the model is able to simulate correctly the main physical processes that occur inside of the lower urinary tract: the motion resistance of the urethral walls, their deformability to intramural pressure variation, the presence of localized or distributed obstructions.