# Damping of solitary waves by obstacles

Diana De Padova and Michele Mossa
DICATECh, Polytechnic University of Bari, Italy
CoNISMa, Rome, Italy

Abstract
Vegetation plays a pivotal role in fluvial and coastal flows, affecting their structure and turbulence, thus having a strong impact on the processes of transport and diffusion of nutrients and sediments, as well as on ecosystems and habitats. Mangroves are a natural defense of the coastal strip against tsunamis and extreme waves. Furthermore, innovative techniques of naturally based coast defense are increasingly used, according to the canons of eco-hydraulics. Moreover, the lagoons and estuary areas with the presence of poles for mussel farming or for guiding boats are not rare, such as, for example, the so-called briccole in Venice (figure 1). Therefore, it is important to be able to correctly evaluate the transmission of waves through cylinder arrays, both to evaluate their coastal protection capacity, and for a correct design of protection structures, such as mangrove restoration.
In the present paper, the attenuation of solitary waves propagating through an array of rigid emergent and submerged cylindrical stems on horizontal and sloped bottom is theoretically investigated. The results of the theoretical model are compared with the numerical simulations obtained with the SPH-Smoothed Particle Hydrodynamics meshless Lagrangian numerical code and with experimental laboratory data. In the latter case, solitary waves were tested on a background current, in order to reproduce more realistic sea conditions, since the absence of circulation currents is very rare in the sea. The comparison confirmed the validity of the theoretical model, allowing its use for the purposes indicated above. Furthermore, the present study allowed an evaluation of the bulk drag coefficient of the rigid stem arrays used, as a function of their density, the stem diameter and their submergence ratio.

Figure 1. Example of interactions of waves and obstacles (typical so-called briccole of Venice).