UNIVERSITY OF THESSALY
School of Engineering - Department of Civil Engineering

Series of Scientific Lectures
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Nonlinear Waves in Open Channel Flow: A Dynamical Systems Approach

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Hybrid Seminar: **Room A1**, MS Teams
Live Streaming: DIAVLOS, YouTube

Abstract:

Monoclinal Flood Waves, Undular Bores, Roll Waves and Solitons are among the most iconic *travelling waveforms* observed in Open Channel Flow. On the other side of the spectrum, the Hydraulic Jump, often encountered in open channels, constitutes a paradigmatic example of a *standing waveform*. In this lecture we will show how the generalized Saint–Venant Equations —governing shallow water flow— reduce to a second–order nonlinear Ordinary Differential Equation (ODE) capturing the shape of all standing and travelling waveforms appearing in Open Channel Flow. To analyze the aforementioned 2nd–order ODE we adopt a Dynamical Systems approach, i.e. we treat it as a set of two coupled 1st–order ODEs. From this perspective, all travelling waveforms manifest themselves as bounded trajectories in the phase space (local slope vs. local flow depth of a wave) of the dynamical system. The Dynamical Systems approach provides an unprecedented, tangible geometrical insight on the structure of the various waveforms in Open Channel Flow.