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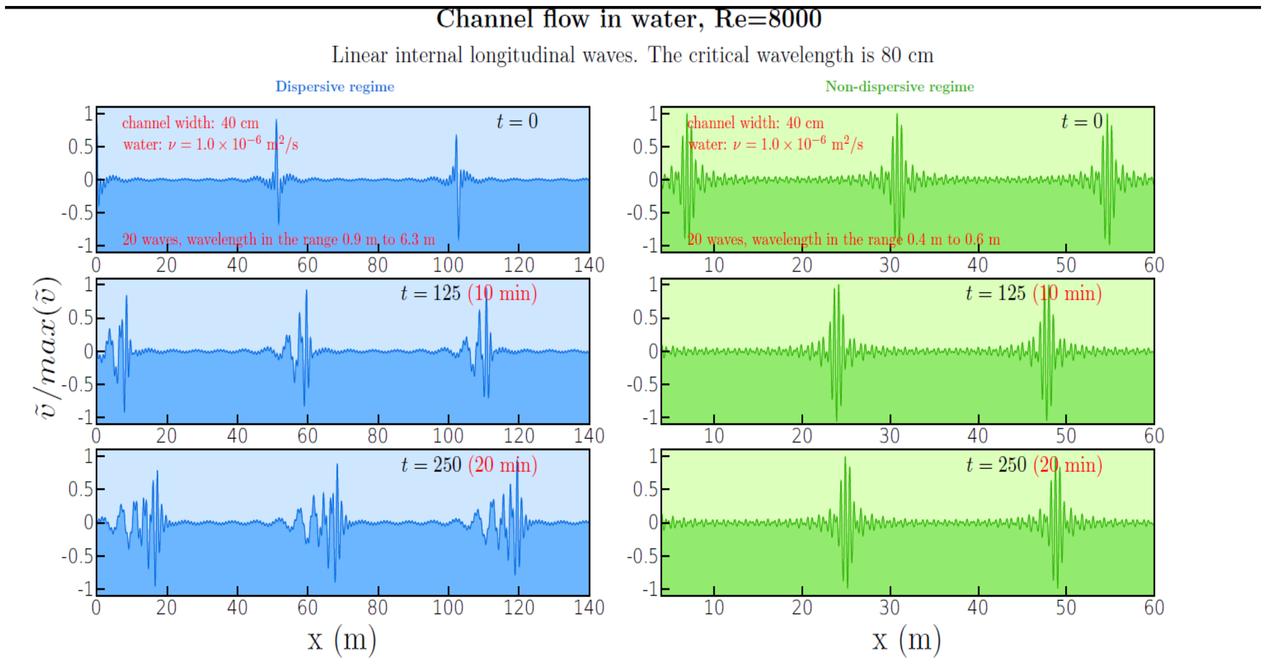
PRESS RELEASE

WAVES IN FLUIDS: GOVERNING MECHANISMS REVEALED

A research from the Politecnico di Torino, published on the prestigious journal Physical Review E, explaines the wave dispersion in fluids, with possible applications from hydraulic micro-systems design to meteorology

Torino, 22 March 2016- The first detection of gravitational waves which took place a few weeks ago has brought to the attention of the general public a physical phenomenon already theorized, but demonstrated only in that occasion: waves carry information and can be bearer of extraordinary (or extreme) events occurred far away in space and time, as in this case.

A research by **Daniela Tordella**, from the Department of Mechanical and Aerospace Engineering of the Politenico di Torino sheds some light on the propagation of an other kind of waves, the waves internal to fluids in motion. All of us are completely immersed in waves, electromagnetic or sound, to name some types of “internal” waves, i.e. that propagate within a fluid, such air and water. The research of the Politecnico, carried out through over 130000 numerical simulations, shows that groups of small-amplitude waves that propagate inside fluids in motion have different ways of propagation depending on their wavelength; the study, which will be published in the prestigious scientific journal **Physical Review E**, talks about **"dispersive"** or **"non-dispersive” regimes**.



To understand the difference between the two systems, one can refer to the behavior of waves everybody can observe: imagine a lake where a stone is thrown into. Surface waves will be observed, which by analogy give an idea, visually, of the behavior of the internal waves that are generated in the same lake. As long as the wavelength (i.e. the distance between two ridges) is below a certain threshold, a wave packet remains compact and all waves propagate at the same

Contacts:
RELAZIONI CON I MEDIA - POLITECNICO DI TORINO
Resp. Tiziana Vitrano, Elena Foglia Franke - tel. +390115646183/6286 - fax +390115646028 - relazioni.media@polito.it
Facebook: http://www.facebook.com/politecnicotorino - Twitter: @poliTOnews

speed. By contrast, when the wavelength is above the threshold, which depends on the ratio between the kinetic energy (mechanic) and the internal energy of the system, a group of waves with similar length spread and the single waves propagate with different speeds with respect to the initial group. In particular, they propagate slower than the group is the flow is confined by walls, faster if the flow is unbuonded. This is an example of **"dispersive" waves**.

Examples of **non-dispersive waves** are the propagation of light in vacuum or the sound waves in air. In this case, any waveform propagates without changing its shape.

This phenomenon, now shown theoretically, could lead to potential applications in various fields. From hydraulic micro-system design (systems containing micro-channels, pipes with micrometric diameter used i.e. in dosimeters, film deposition, heat exchangers for refrigeration and conditioning), to applications in optical fibres, encryption, up to the study of large-scale systems dynamics, as atmospheric and oceanic flows, with potential effects on weather forecasting or climate models.

The article in the online Physical Review E:
http://journals.aps.org/pre/abstract/10.1103/PhysRevE.93.033116

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Resp. Tiziana Vitrano, Elena Foglia Franke – tel. +390115646183/6286 - fax +390115646028 – relazioni.media@polito.it
Facebook: http://www.facebook.com/politecnicotorino - Twitter: @poliTOnews