University of Belgrade

Faculty of Civil Engineering & UNESCO Chair in Water 4ESD

We are pleased to announce that Professor Bojan Guzina, from the University of Minnesota will give a lecture on January 25th, 2016, starting at 13:00, in the Building of Engineering, Main Hall, on the first floor. Bul. Kralja Aleksandra 73, Belgrade.

What Lies Beneath

Professor Bojan Guzina

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Waveform tomography and in particular inverse obstacle scattering are essential to a broad spectrum of scientific and technological disciplines, including sonar and radar imaging, geophysics, oceanography, optics, medical diagnosis, and non-destructive material testing. In general, any relationship between the wavefield scattered by an obstacle and its geometry (or physical characteristics) is nonlinear, which invites two overt solution strategies: (i) linearization via e.g. Born approximation and ray theory, or (ii) pursuit of the nonlinear minimization approach. Over the past two decades, however, a number of *sampling methods* have emerged that both consider the nonlinear nature of the inverse scattering problem and dispense with iterations. Commonly, these techniques deploy an indicator functional that varies with spatial coordinates of the trial i.e. sampling point, and projects the sensory data (namely observations of the scattered field) onto a functional space reflecting the 'baseline' wave motion in a background domain. This indicator functional, designed to reach extreme values when the sampling point strikes the anomaly, can be formulated from either a mathematical or a physical standpoint. An example of the former approach is the so-called *linear sampling* (LS) method, while the latter methodology is perhaps best exemplified via the *topological sensitivity* (TS) approach. This talk will cover the mathematical formulation and experimental validation of both imaging techniques in the context of elastic (i.e. seismic or ultrasonic) waves, including a recent backing of the TS approach within the framework of catastrophe theory. Applications discussed will include non-destructive material testing of the next-generation nuclear reactors, medical imaging, and seismic monitoring of the hydraulic fracturing process.