UNIVERSITY OF THESSALY School of Engineering - Department of Civil Engineering

Series of Scientific Lectures Academic Year 2022-2023

Computational study of separation of magnetic nanoparticles from fluids in biomedical and environmental applications

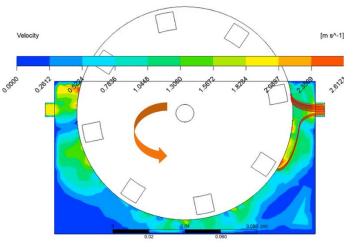
Nikolaos Maniotis University of Thessaly, Volos, Greece

Wednesday **22/2/2023**, Time: **11:15** Hybrid Seminar: **Room A1**, <u>MS Teams</u> Live Streaming: <u>DIAVLOS</u>, <u>YouTube</u>

Abstract:

The process of migration of magnetic nanoparticles and colloids in solution under the influence of magnetic field gradients is an essential step in separation technology used in various biomedical applications. In addition, several environmental applications of magnetic nanoparticles have already been implemented on a large scale, such as wastewater treatment and pollutant removal. In some of these applications, magnetic nanoparticles are added to circulating water to purify it from toxic substances such as hexavalent chromium. The first objective of this lecture is to approach the artificial removal of magnetic field, through a mathematical model corresponding to the model of targeted drug delivery and to determine the conditions under which their separation becomes

possible. The second objective is to study the removal of magnetic nanoparticles from drinking water with the further development of a pilot device. This consists of a rotating disc on which rectangular NdFeB permanent magnets are hosted in a Halbach arrangement (Figure). In both cases presented, the study is done computationally in two and three dimensions by numerically solving the differential equations and simulating the trajectories of the particles, for



different combinations of values of the parameters that affect the movement, estimating each time the percentage of the particles that are being removed by the magnetic field, with the aim of identifying the optimal conditions for their complete elimination.