Research subjects proposed – cycle 36

Curriculum: _3_ (see below)

Title: Analysis and risk assessment of petrochemical tank farms endowed with innovative metamaterials based on Gaussian process regression
P.I. : Oreste S. Bursi **Co-P.I.: Marco Broccardo**
Synthetic description of the project and research outcome (see below): The Ph candidate will develop and apply risk-based methodology for assessing critical tank farms composed of broad and slender steel tanks of a typical petrochemical plant. Therefore, he/she will consider the tank farms subjected to a systematic list of top events and accident conditions caused by hazards on tank components leading to a loss of containment or physical damage owing to seismic loading. Thus, performance levels and critical scenarios for seismic events will be quantified. Then, a framework that relies on high-fidelity models for unanchored tanks based on 3D finite element (FE) models set in the ABAQUS software and uses low-fidelity demand models based on Gaussian process regression models, i.e. Kriging models, which allows for cheaper simulations of the system model is set and applied. The novel concept of periodic metamaterials or metastructures will be applied to the vibration mitigation of tank farms of a petrochemical plant subjected to both seismic volumetric and surface waves. In greater detail and with regard to vibrations due to the impulsive components of the contained fluids, new tank farms will be conceived with novel periodic smart -mass and mass- foundations endowed with resonators; whilst existing tanks will be equipped with periodic resonators. Moreover, tanks will also be treated as resonating systems by themselves. These novel design concepts will also be explored for other examples of important finite lattice structures, like tanks used in regasification stations or reactors of nuclear power plants.

Curricula

1. Civil and Environmental Engineering
2. Mechanics, Materials, Chemistry and Energy
3. Modelling and Simulation
4. Architecture and Planning, Landscape

Provide a short description of the research project, including the expected research outcome (e.g., patents, papers, books, etc.). Research projects may include more than one proposed topic for PhD Thesis.