CIVIL AND ENVIRONMENTAL ENGINEERING

CRT (ISSNAF) - Electrochemical strengthening of soils in the context of coast protection

Funded By	FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014]
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Context of the research activity	Coastal areas host approximately half of the world's population and increasingly suffer from the disintegration of civil infrastructure due to soil erosion caused by global sea-level rise and extreme weather events. Traditional approaches to mitigate the impacts of erosion on coastlines and shoreside infrastructure consist of the injection of fluids to cement soil particles. These approaches imply high energy consumption, significant carbon footprint and adverse environmental impact. Current research aims at developing a novel class of treatments that leverages the electrochemical process of electrodeposition to turn naturally dissolved minerals in the pore water of soils and concrete into solid binders.
Objectives	The project is related to a common research activity between the geotechnical group of Politecnico di Torino (Prof. Guido Musso) and Northwestern University (SOIL: the Subsurface Opportunities and Innovations Laboratory, Prof. Rotta Loria). The scholarship is reserved for students who obtained their MSc degree from a US university. A part of the PhD will be carried out in the US institution of origin. In Torino, the main aspects covered will be related to the numerical modelling of electro-chemical transport processes in soils, with special reference to the induced precipitation of species close to the cathode. A limited experimental campaign might be carried out in the geotechnical laboratory, to evaluate the mass of precipitated species in small-scale experiments and their impact on the strength of the soil. In the US institution of origin, the PhD candidate will carry out bench-scale tests to evaluate the effect of the electrochemically induced precipitation of species on resistance to erosion of sandy layers. Test results will also serve for calibration/verification of the implemented numerical models. The research topic will be developed in collaboration with a faculty member from ISSNAF (Italian Scientists & Scholars in North America Foundation), as part of the collaboration agreement signed with the Politecnico di Torino. The grant is founded by CRT inside ISSNAF program. The selected candidate must spend at least 12 month in north America partner University.

Skills and competencies for the development of the activity	Master of Science in Engineering/Architecture disciplines Programming skills Independent thinking The candidate must hold a MSc degree from a US university