BOISE STATE UNIVERSITY
ELECTRICAL & COMPUTER ENGINEERING

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Electromagnetic Waves for Geotechnical/Geoenvironmental Applications

ABSTRACT

In-situ remediation techniques that enable the removal of contaminants are, in general, relatively slow and ineffective. Electromagnetic (EM) waves have long been used for nondestructive detection and monitoring of anomalies in soils. The goal of this work is to study the use of electromagnetic (EM) waves—with minimal heat generation—to enhance various mechanisms in order to improve or expedite the cleanup process. This efect was studied through an experimental setup that examines flow of a nonreactive dye and air-channel formation within aqueous and/or porous media under EM stimulation at a range of frequencies between 50 and 200 MHz. The electric fiield and flow were numerically simulated for better 3D visualization and analysis and then validated using experimental measurements. A dielectrophoretic study was then performed using the simulated electric field. Various dye flow and air-channel formation scenarios under EM stimulation at different frequencies were compared. The side effects of EM waves on the hydraulic conductivity of soils were also studied and analyzed. Models were then created to correlate the EM waves' characteristics and the flow and hydraulic-conductivity alteration.

BIOGRAPHICAL SKETCH:

Dr. Arvin Farid joined the faculty of the Civil Engineering Department at Boise State University in the spring of 2008. Prior to coming to Boise State, he worked as an Associate Research Scientist at the Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS) at Northeastern University, Boston, MA. His research currently includes electromagnetic stimulation of transport mechanisms to enhance soil remediation, the effect of electromagnetic waves (EM) on soil properties (e.g. hydraulic conductivity), liquefaction mitigation, and material characterization. Dr. Farid received his Ph.D. in Civil Engineering from Northeastern University in Boston in 2004.

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