Conferencistas Magistrales

Nicholas Vlachopoulos

Topic: Unprecedented Insight into the Geomechanics Associated with the use of Ground Support using fiber optics

Dr. Nicholas Vlachopoulos is a Professor of Civil Engineering at the Royal Military College of Canada, Cross-Appointed at Queen's University and is a Director at the Queen's-RMC GeoEngineeirng Center. He is also the Founder and Director of the RMC Green Team that addresses Infrastructure and Environmental Engineering issues within the Canadian Department of National Defence. He specializes in the optimization of support systems of underground works, rock mechanics, geotechnical monitoring and military sustainability. He is a professional engineer (in Canada and in Greece) with over 25 years of experience in geotechnical / geological engineering, sustainability works and project management on major construction and research projects. He has worked at well over 150 locations nationally and internationally. Dr. Vlachopoulos was recently awarded the Thomas Roy Award by the Canadian Geotechnical Society (CGS) for "outstanding contribution to Engineering Geology in Canada"; This is the Premier Engineering Geology Award in Canada. He is also the immediate past Engineering Geology Division Chair for the CGS and Canadian Representative of the IAEG.

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In this presentation, a distributed optical strain-sensing technique is presented as a solution for measuring the strain distribution along ground support members used in underground works in conjunction with the relevant concepts associated with geomechanics. The technique employs a Rayleigh optical frequency domain reflectometry technology, which measures strain at a spatial resolution of 0.65 mm along the length of a standard optical fiber. The development of a technique to couple optical fiber sensors with rock bolt, umbrella arch, and cable bolt support members demonstrated. A robust laboratory investigation of such optically instrumented support members demonstrated the capability of the technique to capture the expected in situ support behaviour in the form of coaxial, lateral, and shear loading arrangements as would be anticipated in the field. Moreover, the microscale data obtained by this optical sensing technique are shown to provide unprecedented insight into the local/micro-scale geomechanistic complexities associated with the bearing capacity of ground support members, especially when compared with data obtained by discrete strain-sensing technologies. The results from the laboratory component of the overall research project have also been used to calibrate and validate Numerical models. The technique has also been employed at underground construction sites around the world and has been used to improve and/or validate support design. The methodology can also be employed as a "probe" in order to sense the ground ahead of the excavated face as well as optimize the support scheme associated with underground works.