

## Development of an Optical Soil Moisture Sensor for Agricultural Applications

*Corsi M. Atiglo<sup>1</sup>, Maria Thereza M. R. Giraldi<sup>2</sup>, Maria Aparecida G. Martinez<sup>1</sup>*

<sup>1</sup> Departamento de Pós Graduação em Engenharia Elétrica, Centro Federal de Educação Tecnológica Celso Suckow, Brazil

<sup>2</sup> Departamento de Pós Graduação em Engenharia Elétrica, Instituto Militar de Engenharia, Brazil

In this work, we report the analysis and the development of a fiber optic grating sensor based on long-period grating (LPG) coated with a hydrophilic material as a promising technology for measuring soil moisture. The operating principle of LPG is explored, which is based on the modulation of the wavelength of light due to variations in the refractive index of the surrounding medium. We discuss how these variations are directly related to changes in soil moisture, making LPG suitable for this application.

## Multifunctional structure for temperature measurement in different environmental conditions

*Robertson Pires-Junior<sup>1</sup>, Arnaldo Leal-Junior<sup>1</sup>, Anselmo Frizera<sup>1</sup>*

<sup>1</sup> Electrical Engineering Postgraduate Program, Federal University of Espírito Santo, Brazil

This article presented the development of a multifunctional structure for temperature monitoring in different environments. This multifunctional structure was manufactured using a commercial resin used in 3D printing and an optical fiber inscribed with a Bragg grating (FBG). Then, the structure was subjected to different tests to investigate the influence of the effects of humidity and temperature on the Bragg grating wavelength ( $\lambda_B$ ). In the first test, it was submerged in a reservoir with water, while in the second the structure was positioned inside a climate chamber. It was observed in the results that the moisture absorbed by the resin has less influence on the variation of  $\lambda_B$  than temperature. Furthermore, the multifunctional structure showed a temperature sensitivity of 33.02 pm/°C in the temperature range of 25°C to 40°C.

## Enhancement of Temperature Predictions in Interferometric Sensors by Using KNN Regressions

*José Carmen M. Castro<sup>1</sup>, Ana D. Guzman-Chavez<sup>1</sup>, Everardo Vargas-Rodriguez<sup>1</sup>, Rafael G. Cabrera, Juan Jose P. Medina<sup>1</sup>, Roberto Jaime C. Jurado<sup>1</sup>*

<sup>1</sup> Department of Multidisciplinary Studies, University of Guanajuato, Mexico

In this research study, we used the K-nearest neighbors regression (KNN regression) to estimate temperature, based on certain features of an interferometric sensor's spectrum. Typically, these systems face limitations in their measurement range due to various ambiguities induced by physical effects, such as non-linear relationships between wavelength peaks of fringes and temperature, and furthermore, after a certain temperature change, fringes shift to the position of adjacent fringes. As a demonstration, experimental results are presented showing that by employing KNN regression the measurement range can be extended by a factor of 2 with a RMSE of 0.06 °C.