

# **Research on a novel co-surface capacitive sensor for positioning prestressed tendon in grouting duct**

**Rui Cai<sup>1</sup>, Wenlong Tao<sup>1</sup>, Hangben Du<sup>1</sup>, Nan Li<sup>2</sup>**

<sup>1</sup>School of Automation, Northwestern Polytechnical University, China, <sup>1</sup>School of Automation ,  
Northwestern Polytechnical University, China

Reliable assessment of the grouting quality of prestressed ducts in post-tensioned concrete structures is essential to ensure construction safety. Determining the position of prestressed tendons in the ducts is considered a prerequisite for effective damage detection and quality assurance of prestressed ducts. Capacitive sensing detection technology is one of the main research directions in the field of non-destructive testing, with remarkable achievements made in the quality detection of grouting ducts. Therefore, this paper proposes a capacitance sensor with coded characteristics in structure. The sensor is composed of three stationary electrodes and one active electrode, and the measurement of capacitance can be achieved by the rotation of the active electrode around the duct, through which significant amounts of data can be obtained. A model of grouting duct with an inner diameter of 80mm and an internal prestressed tendon with a diameter of 16mm is constructed in the simulation. The simulations of prestressed tendons at different angular and radial positions indicated that, the tendons can be preliminarily positioned within an area of 120° based on uniformly distributed positions of stationary electrodes. When calibrating the absence of prestressed tendon in the duct as a reference electrical signal, based on the maximum amplitude difference, the angular position error is determined to be 0°, while the resolution of radial position is determined to attain 5mm. It is suggested that the above method is capable of accurately positioning, which is expected to provide guidance for future detection of prestressed tendon in grouting ducts.