Characterization of an Interdigitated Capacitive Structure With Branches for Relative Humidity Sensing

Abstract:
An interdigitated capacitive structure whose fingers have branches across them is described in this article. By changing the traditional interdigitated electrodes (IDE), the area where the sensor is defined can be reduced by a third, while its capacitance and sensitivity are maintained. This enhancement with respect to the traditional one is obtained thanks to the contribution to the capacitance not only in the finger length direction (unidimensional) but also in the finger width dimension (2-D). In order to test the sensitivity enhancement of this device in comparison with the conventional IDE, two version of this structure and the classical IDE have been manufactured by inkjet printing on flexible foil and characterized as relative humidity (RH) sensor. For this purpose, a substrate whose electrical permittivity changes with moisture content has been selected. Their capacitances have been measured as a function of RH in a wide range of frequencies at different temperatures, obtaining comparable results as a function of the RH and temperature. However, in the case of the sensor with closer branches, the response changes above 50%RH, showing a significantly higher sensitivity due to the fact that electrodes are much closer than in the other structures. The accumulation of water molecules between consecutive fingers occurs at lower values of moisture content than in the other layouts, resulting in higher capacitance values due to the higher electrical permittivity of water.