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A theoretical study of an improved capacitive pressure sensor:

Closed-form solution of uniformly loaded annular membranes

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Abstract: In this study, the conductive diaphragm in conventional capacitive pressure sensors with dual function (the deformable element and the upper electrode plate of a non-parallel plate capacitor) was modified into a non-conductive elastic annular thin-film (as the deformable element) centrally connected with a conductive rigid circular plate or alternatively with a non-conductive rigid circular plate adhered by a conductive thin-film (as the upper electrode plate of a parallel plate capacitor). This modification brings two advantages: the parallel plate capacitor is more convenient in the accurate calculation of capacitance than a non-parallel plate capacitor; it is easier to select a deformable element with good elastic behavior in non-conductive elastic thin-films than to select such a deformable element in conductive diaphragms. These advantages could provide convenience for further improving the performance of sensors. The presented closed-form solution can meet the needs of the research and development of this improved capacitive pressure sensor.

Keywords: Capacitive pressure sensor; Parallel plate capacitor; Annular membrane;

Closed-form solution

1. Introduction

Capacitive sensors are often used in a variety of control, monitoring, diagnosis and other fields [1-3], and they have the advantages of low power consumption, high

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