Ferroelectret Coaxial Sensor (FCS) with Radial Polarization

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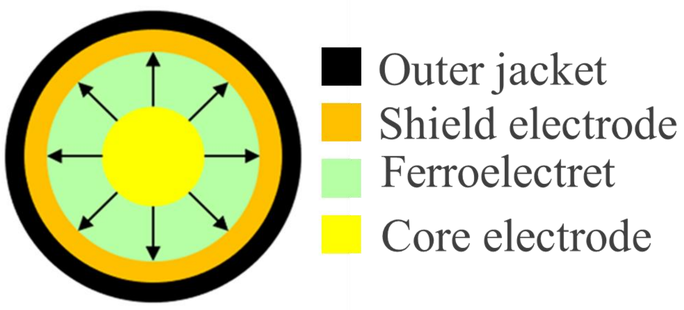
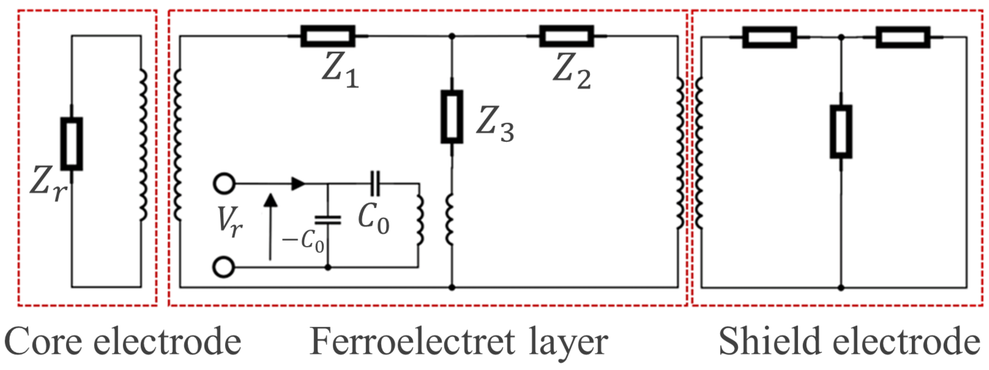
Introduction

Ferroelectret coaxial sensors (FCSs), featuring high sensitivity, flexibility, waterproofing and self-shielding and unlimited length, are expected to have a great potential in the Internet of Things (IoT). The FCS is composed of an inner electrode, a thin layer of ferroelectret film, an outer and shield electrode and an insulating outer sheath. In this paper, the three-port electromechanical equivalent circuit model of the radially polarized FCSs in radial vibration model is given. The properties of the FCSs are studied theoretically and experimentally.

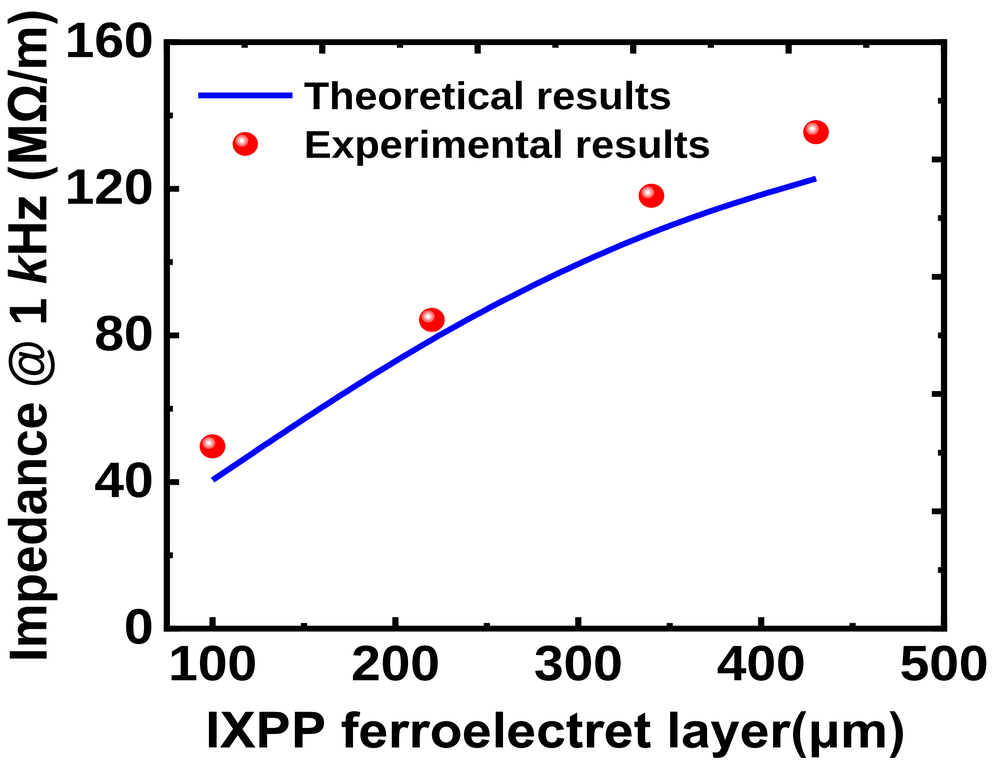
Structure of Ferroelectret Cable



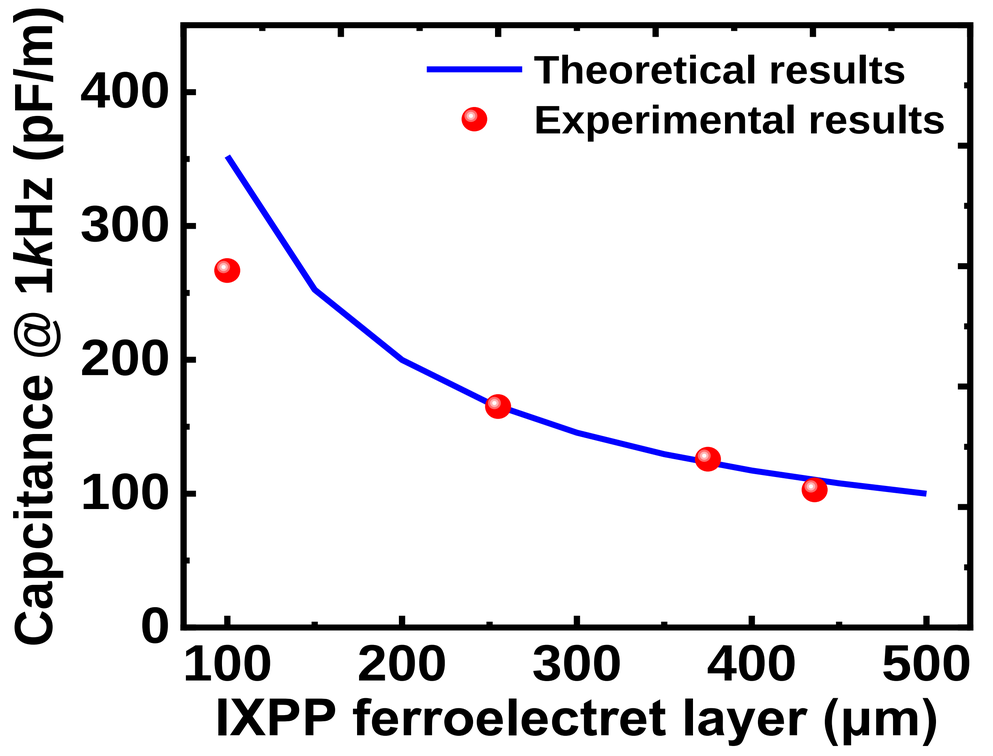
Three-port Electromechanical Equivalent Circuit



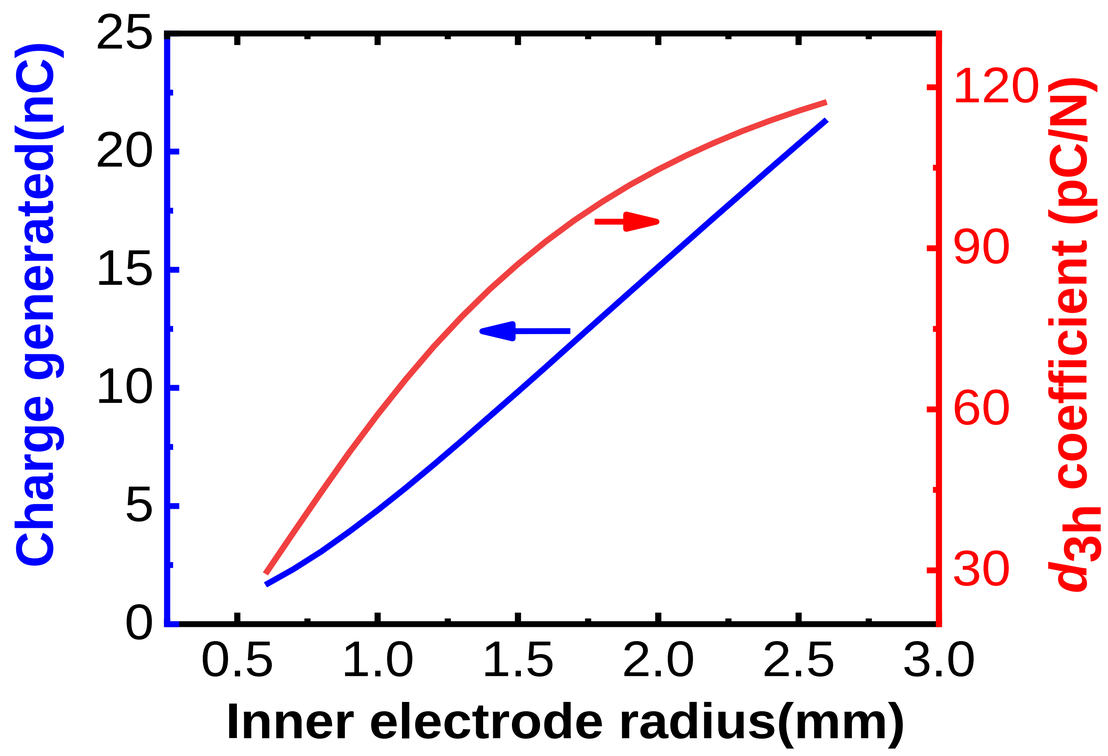
Capacitance vs thickness of ferroelectret layer



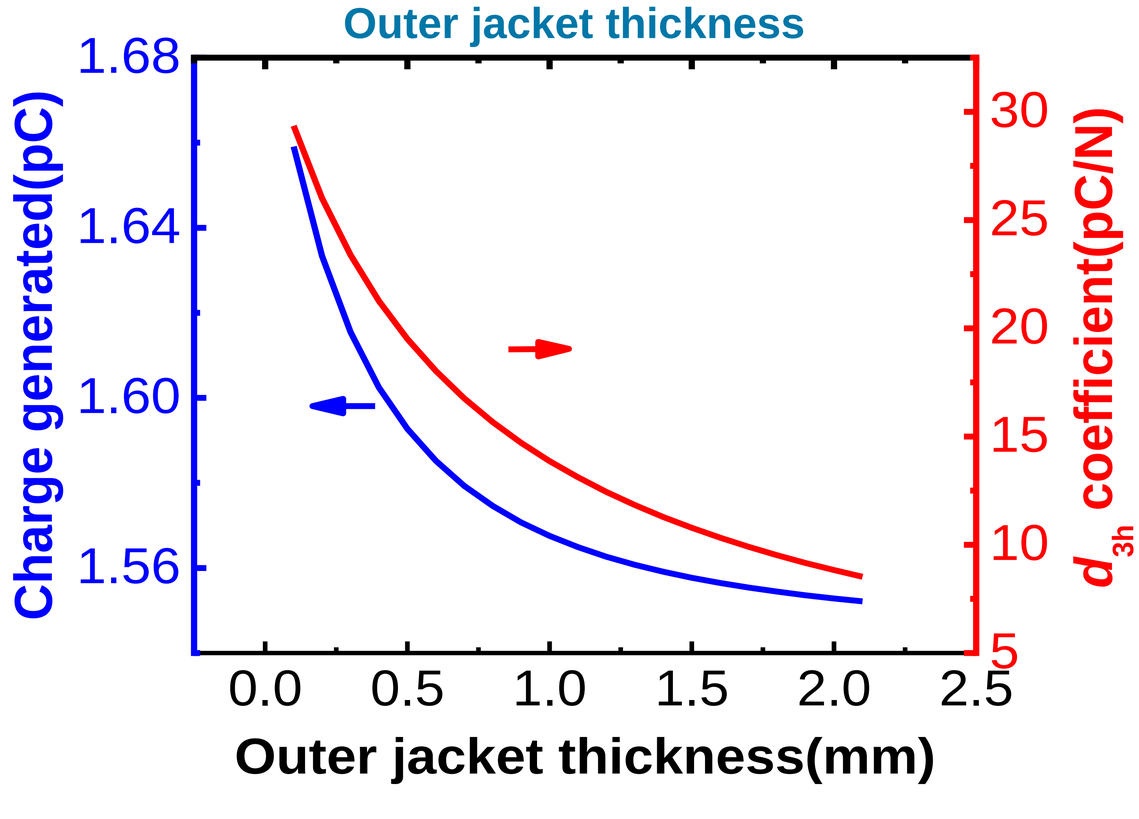
Impedance vs thickness of ferroelectret layer



Charge generated and d_{3h} coefficient vs Inner electrode radius



Charge generated and d_{3h} coefficient vs Outer jacket thickness



Results and discussion

- The maximum error of the static capacitance and impedance are 16.6% and 18.1%. These results depict that the equivalent circuit model is reasonable.
- The generated charge Q and hydrostatic piezoelectric coefficient d_{3h} increase with increasing the diameter of the core electrode.
- Increasing the thickness of outer jacket thickness causes a decrease of Q and d_{3h} coefficient.

Conclusion

- The electromechanical equivalent circuit model of radially polarized FCS in the process of radial vibration is derived;
- The theoretical model of charge quantity and d_{3h} coefficient generated in the process of quasi-static compression under uniform pressure load on its outer surface is established.