CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1. An increase in the applied load results in changes in voltage, current, and power due to mechanical deformation occurring in the sensor. Under AC conditions, the generated output tends to be more fluctuating and decreases in several samples, whereas under DC conditions, the output is more stable. Among all samples, PLRCZ exhibits the best performance, producing the highest and most stable output with increasing load.
2. In the series configuration, the PTL sample demonstrates a relatively consistent increase in voltage, current, and power. Similarly, the PLRCZ sample in the series configuration shows comparable improvement with a relatively stable response as both frequency and load increase. In the parallel configuration, the PTL sample produces lower voltage, current, and power, and exhibits a more fluctuating pattern compared to the series configuration. In contrast, the PLRCZ sample in the parallel configuration shows superior performance, characterized by stable current, higher power output, and a more pronounced increase in output with increasing frequency and load. Therefore, the parallel configuration of the PLRCZ sample is more optimal for achieving higher power output with good current stability.
3. The piezoelectric sensor coated with Zn-doped CDs (PLRCZ) demonstrates the best performance compared to the PTL, PLR, and PLRC samples. The Zn-doped CDs coating plays a dominant role in enhancing the mechanical reinforcement of the sensor, leading to a more uniform and optimal distribution of applied pressure. This effect is evident in the single-element sensor testing, where PLRCZ achieves the highest output $of\ 8{,}21 \times 10^{-4} W$, as well as in the parallel configuration, which shows a significant increase in output up to 1×10^{-2} W.

5.2 Recommendations

1. The range of applied load variations should be expanded to better represent actual conditions of speed bumps in real-world applications.
2. The generated electrical energy output should be integrated with an energy storage system, such as a battery or accumulator, to enable effective utilization of the harvested energy.
3. The application of Zn-doped CDs as a coating on the surface of piezoelectric sensors requires further investigation, particularly regarding the influence of their photoluminescence properties on the enhancement of sensor output performance.
4. Zn-doped CDs samples can be characterized using SEM-EDX analysis to determine the elemental composition contained in the sample in more detail.