A Self-Powered Dynamic Response Sensing Method Driven By Non-Contact Triboelectric Nanogenerators

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Triboelectric nanogenerators (TENGs) are thought to be a promising sensing technology with their unique advantages of passive sensing capability and the outstanding performance in low-frequency environments. Herein, we propose a self-powered sensor based on sliding mode TENGs to realize long-term and continuous monitoring of dynamic responses of civil infrastructures. To improve the precision, a non-contact base structure is designed to prevent the inevitable sliding friction between the tribo-pair. Moreover, a multi-parameter analysis method is applied as the guidance in optimal design of TENG sensors. A theoretical correlation between the structural strain response signals and the sensing signals is established based on a V-Q-ε (voltage-charge-strain) model of TENGs. The measured strains by the proposed device are quantitatively consistent with those from the commercial strain gauges. The proposed intelligent sensor is useful in long-term continuous monitoring of dynamic responses of civil infrastructures. Acknowledgements This work is supported by the National Key R&D Program of China (No.2018YFB1600200), the National Natural Science Foundation of China for Outstanding Young Scientists (No. 52122801), the NSFC General Program (No. 51978609), and the Zhejiang Provincial Natural Science Foundation for Distinguished Young Scientists (No. LR20E080003).