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Data Article

Data of piezoelectric vibration energy harvesting of a bridge undergoing vibration testing and train passage

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ABSTRACT

The data presented in this article is in relation to the research article "Vibration energy harvesting based monitoring of an operational bridge undergoing forced vibration and train passage" Cahill et al. (2018) [1]. The article provides data on the full-scale bridge testing using piezoelectric vibration energy harvesters on Pershagen Bridge, Sweden. The bridge is actively excited via a swept sinusoidal input. During the testing, the bridge remains operational and train passages continue. The test recordings include the voltage responses obtained from the vibration energy harvesters during these tests and train passages. The original dataset is made available to encourage the use of energy harvesting for Structural Health Monitoring.

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Specifications Table *[please fill in right-hand column of the table below]*

Subject area	*Structural Dynamics*
More specific subject area	*Energy Harvesting, Structural Health Monitoring, Bridge Engineering*
Type of data	*Figures, Excel Datasheet*
How data was acquired	*By deploying piezoelectric energy harvesters to a rail-bridge, while exciting the bridge on site using a shaker while allowing train passages.*
Data format	*Raw*
Experimental factors	*The swept sinusoidal excitation was from 3 to 50 Hz with 0.05 Hz/s rate with one exception of 5–10 Hz with 0.01 Hz/s rate with load amplitudes 5 kN and 10 kN respectively. The applied preloads were 15 kN and 10 kN. The natural frequencies of the cantilever piezoelectric energy harvesters using polyvinylidene fluoride (PVDF) material were 6.09 Hz, 7.11 Hz, 8.37 Hz, 15.75 Hz, 17.95 Hz and 20.45 Hz respectively.*
Experimental features	*Energy harvesting signatures recorded for different harvesters due to the response of the bridge related to the swept sinusoidal excitation and train passages.*
Data source location	*Södertälje, Sweden*
Data accessibility	*With this article*

Value of the data

- We expect this to be the first public domain dataset around energy harvesting based monitoring for bridges.
- The data will provide a benchmark for structural health monitoring researchers to overcome real challenges in site conditions, when coming up with methods for analysis or markers for monitoring.
- The data is expected to be an important resource for assessing and developing output-only system identification and monitoring algorithms.
- The data will serve as a key reference for future research in energy harvesting based structural health monitoring.

1. Data

The data provided here is related to deployment and monitoring of Pershagen Bridge, Sweden using piezoelectric energy harvesters [1] and is related to earlier studies on the concept of vibration energy harvesting based monitoring of built infrastructure [2–4]. A total of six energy harvesting devices with different natural frequencies designed around the natural frequency of the bridge are deployed and the bridge is tested using a shaker with swept sinusoidal loading with different frequency ranges and for different magnitudes of loads.

Fig. 1. An example of a piezoelectric cantilever type energy harvester deployed in the bridge.