



Expoziția Internațională Specializată
INFOINVENT

Ediția a XVIII-a, 22-24 Noiembrie 2023



CONTACTLESS STRAIN MEASUREMENT SENSOR BASED ON AMORPHOUS FERROMAGNETIC MICROWIRES

Assoc. prof., PhD. Sergiu ZAPOROJAN; Dr. Sc., prof. Vasile TRONCIU;
PhD. student Eugeniu MUNTEANU; Lilian CHICU; Victor PAVEL.



Goal:

The invention relates to the measurement technique, in particular extensometry, and can be used to measure the deformations of solid bodies subjected to stretching, including irreversible ones, for example critical residual deformations in pressure vessels, in particular in high-pressure composite cylinders.

Solution:

✓ Non-contact measurement of the deformation of solid bodies and reduction of restrictions on the distance/positioning of excitation-detection coils from the sensitive element of the sensor by detection-analysis of the change in magnetic characteristics of materials subjected to mechanical stresses.

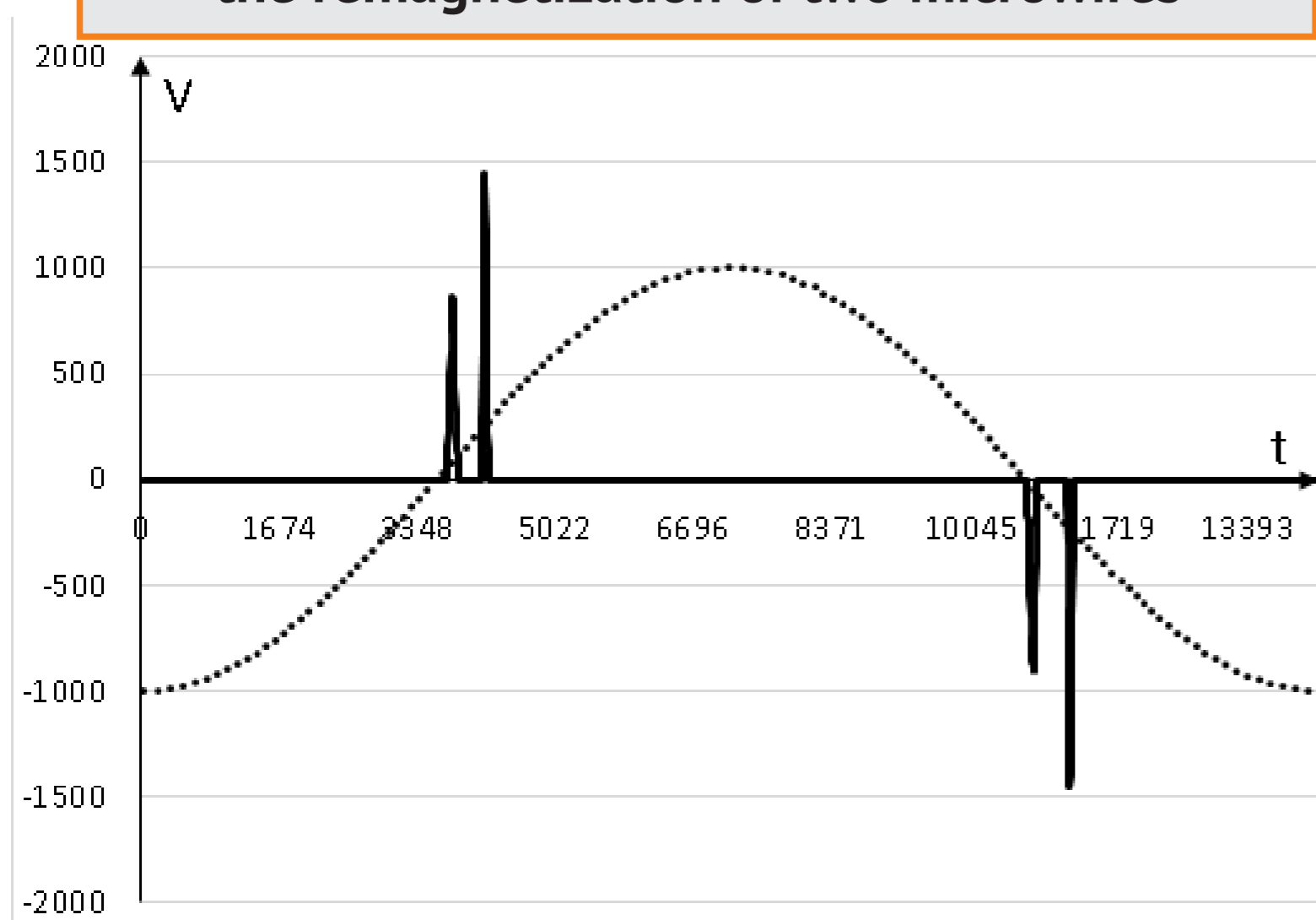
Advantages:

- ✓ reducing the dependence of measurement results on the positioning of the detection device relative to the sensitive element of the sensor;
- ✓ increasing the distance of reliable deformation detection;
- ✓ reduction of measurement errors by compensating the dependence on the ambient temperature;
- ✓ increased stress sensitivity.

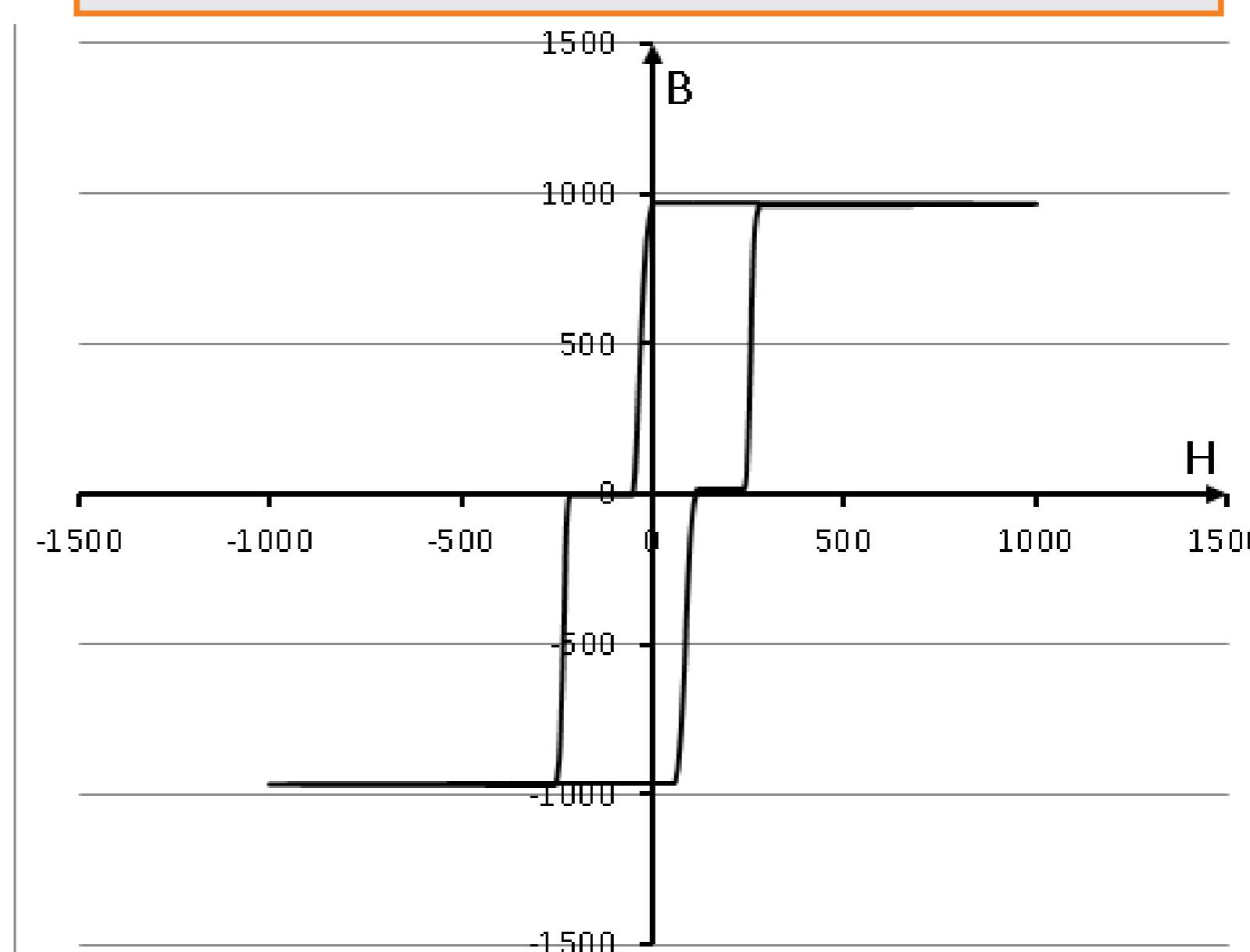
Stage:

Laboratory tests.

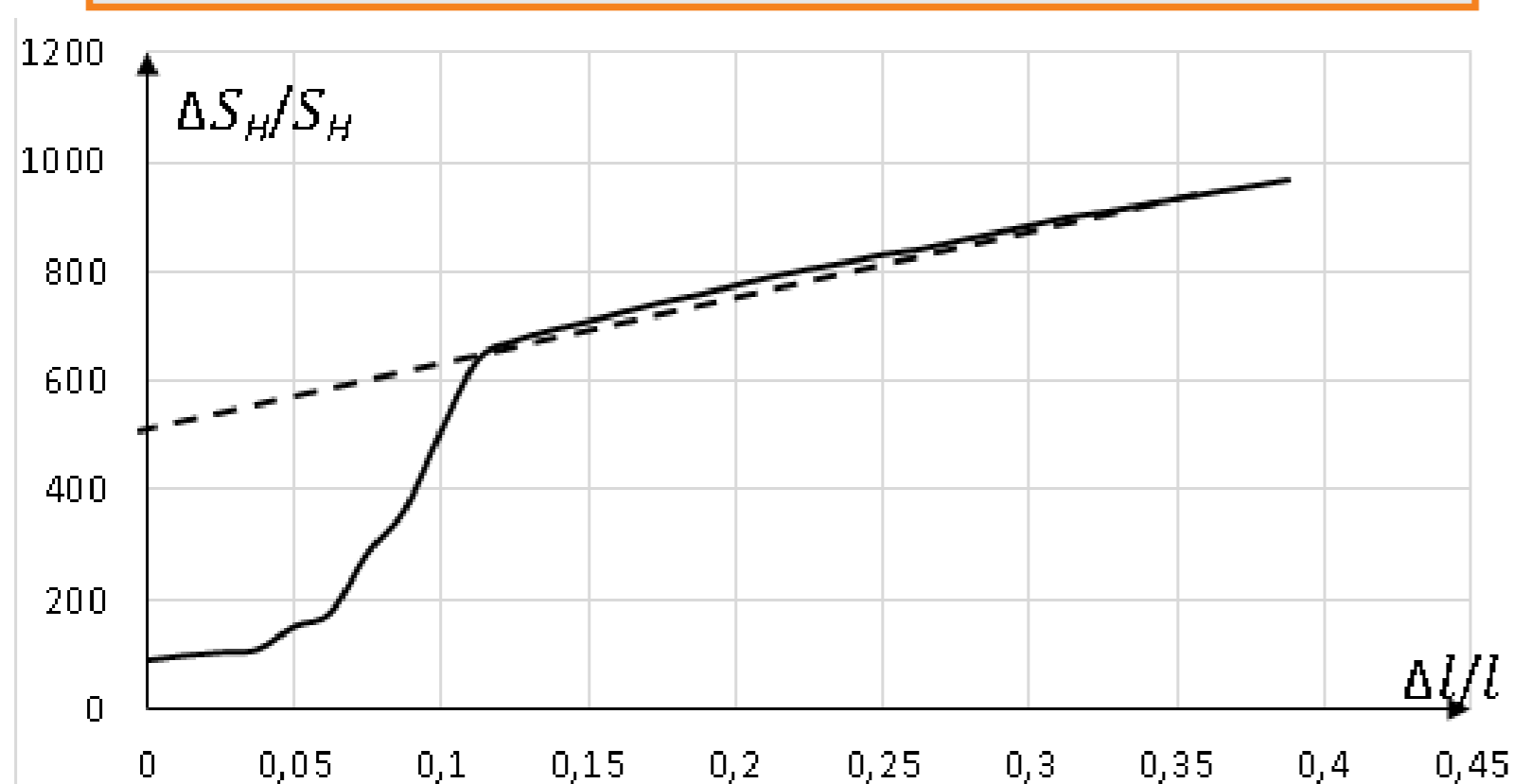
The sequence of response pulses to the remagnetization of two microwires



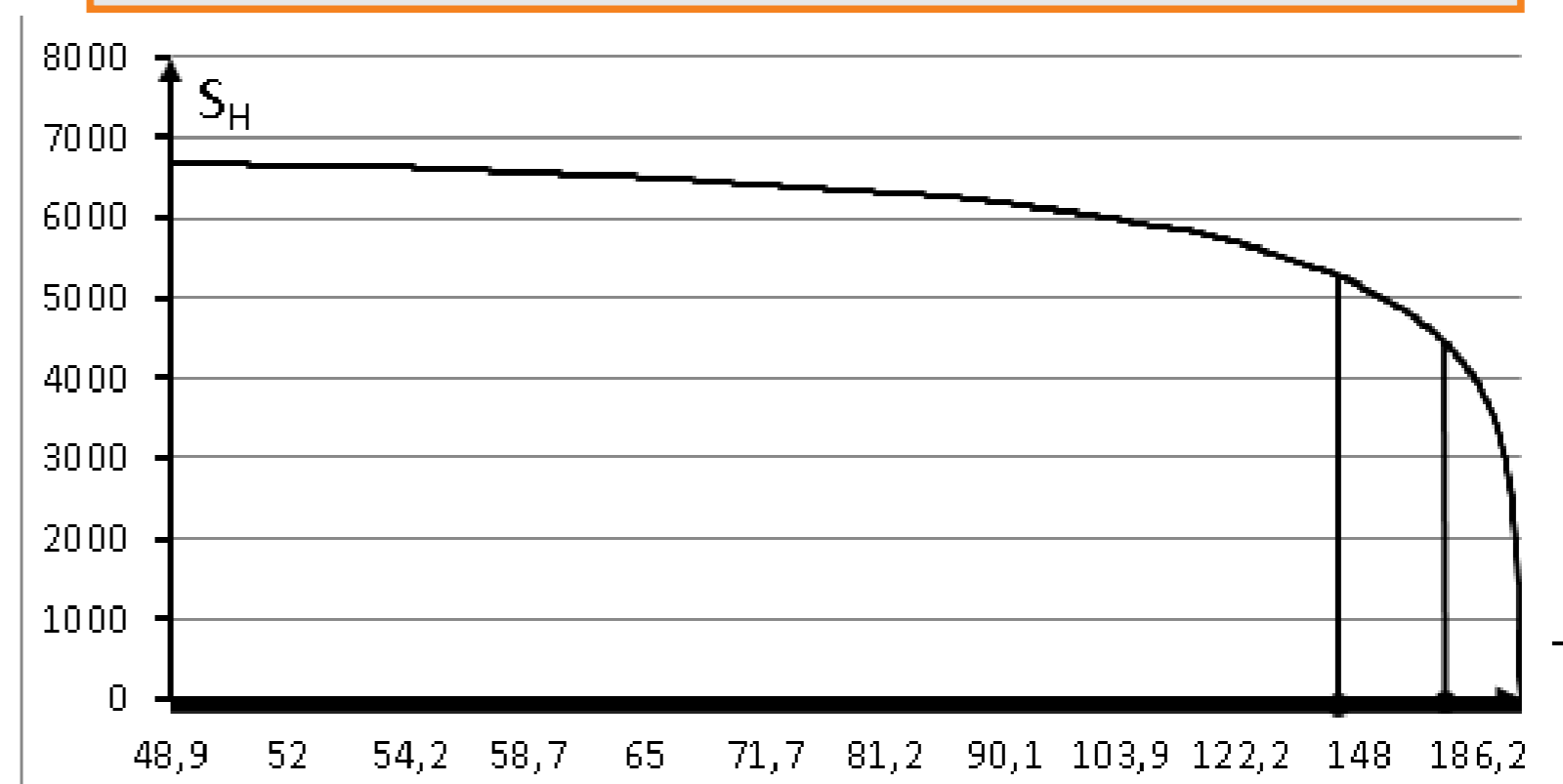
The hysteresis cycle during the remagnetization of two microwires



Dependence of the area of the hysteresis loop on the deformation of the sensitive wire



Hysteresis loop area of a reference wire as a function of temperature



The parameters of reference microwire do not depend on the deformation. Comparing the magnetic characteristics of the hysteresis loops, the magnitude of deformation is determined. The sensor can be applied in condition-based monitoring of bodies/equipment subjected to mechanical stress.

The contactless strain sensor consists of at least two segments of amorphous ferromagnetic microwires – a sensitive wire and at least one reference wire, mounted on a solid body. When an alternating magnetic field is applied, the sensor responds with impulses induced at the remagnetization. The hysteresis loop and coercive force of sensitive microwire with high positive magnetostriction increase with tensile strain.