Project title: Researches on the achievement of ecologic technologies based on magnetostrictively induced vibrations with a view to reducing the energy consumptions having as effect the global warming

Phase no. **: 2 Functional model of the vibratory stress relief equipment, with magnetostrictive vibrator**

Planned objectives:
- Design of the functional model for magnetostrictive vibrator;
- Design and experimental model of variable frequency and amplitude inverter
- Design of hardware structure for the control of the stress relief equipment;
- Analysis of software application for the control of the vibratory stress relief equipment
- Functional model of the magnetostrictive vibrator
- Experimental model of the hardware structure for the control of the functional model
- Software application for the control of the functional model
- Experimentation of the functional model

Activity description :
Activity II.1 Designing of the functional model for magnetostrictive vibrator

Within the framework of this activity, a magnetostrictive actuator was studied and designed for producing either mechanical shock duties or mechanical vibrations in the frequency range 0 - 1kHZ, necessary to the stress-relief of mechanical stresses in ferromagnetic materials.

The general structure of the magnetostrictive actuator:
- magnetostrictive core
- magnetizing coil
- permanent magnet with coaxial cylindrical geometry
- elastic element for achieving the pre-clamping force
- coil case
- vibrator case
- vibrator plate
- guiding segment
- inertial mass
- coupling disk

Got results: Design – 1 pc.

Stage of achieving the planned objective/finalization form (of the activity within the phase):
The planned objective was achieved and finalized as „Design of the functional model for magnetostrictive vibrator”

Activity II.2 Designing and achievement of variable frequency and amplitude inverter

The variable frequency and amplitude inverter is intended to supply electric energy to the magnetostrictive vibrator.

The signal (voltage and current) shape at the power supply output is sinusoidal, with controllable frequency and amplitude.

The variable frequency and amplitude inverter consists of the following parts, constructively enclosed in only one case:

- power circuit, achieved as a linear power amplifier, class A;
- control circuit, including a sinusoidal oscillator Wien-Robinson and an automatic regulator for the amplitudes of the mobile equipment of the magnetostrictive vibrator (supplied);
- supply circuits, achieved as a rectifier – capacitive filter for the force side, and rectifier – voltage stabilizer – capacitive filter for the control side.

The distribution transformers have the secondary with midpoint tap, both for the power side and for the control side.

- Digital frequency meter with three digit display, supplied by a rectifier-capacitive filter.

Got results: Design – 1 pc.
Experimental model for inverter – 1pc.

Stage of achieving the planned objective/finalization form (of the activity within the phase):
The planned objective was achieved and finalized as „ Design and experimental model of the functional model for variable frequency and amplitude inverter”

Activitate II.3 Designing of hardware structure for the control of the stress relief equipment

Within the framework of this activity, the design of the hardware structure for controlling the stress relief equipment was achieved.

The block diagram of the magnetostrictive stress relief system – experimental model consists of the following main components:

- PC-03 –Module for controlling the stress relieving process;
- Power supply with control of voltage (U) and frequency (F) amplitude;
- Magnetostrictive device which generates the stress relief vibrations; these vibrations have the frequency pre-set by the module PC-03 at the power supply;
- Tu – voltage transducer (a.c.);
- Ti - current transducer(a.c.);
- Tv – vibration transducer (piezoelectric);
- CC-HVC – conditioning circuit for measuring the frequency of the alternating voltage generated by the power supply;
- CC-RMS-U – conditioning circuit for measuring the effective value of the alternating voltage generated by the power supply;
- CC-RMS-I – conditioning circuit for measuring the effective value of the current absorbed by the magnetostrictive device from the power supply;
- CC-RMS-V – conditioning circuit for measuring the amplitude of the vibrations generated by the magnetostrictive device on the part subjected to stress relief;

- LCD – 2x16 character, alphanumeric liquid crystal display for displaying the current quantities characterizing the controlled process;
- IMB-PC/AT compatible equipment– computational equipment for user interface, carrying out the document displaying, processing, storage and issuing.

Got results: Design – 1 pc

Stage of achieving the planned objective/finalization form (of the activity within the phase): The planned objective was achieved and finalized as „Design of hardware structure for controlling the stress relief equipment"

Activity II. 4 Analysis of software application for the control of the vibratory stress relief equipment

The software application related to the magnetostrictive stress relief equipment has two components:
- PC104 compatible software module

The PC104 compatible software module is implemented at the level of the equipment controlling the magnetostrictive stress relief process PC-03, with a view to measuring the parameters which characterize the process, controlling U and F parameters in accordance with the pre-set work protocols and transferring the data to the IBM-PC/AT compatible equipment.

The PC104 compatible software module, achieved in C++, implements the functions for the acquisition of process parameters, by using the interfaces ADC 104-XA (for the acquisition of analog input quantities) and PC104–DIO&TIMER (for measuring the frequency of the voltage which supplies the magnetostrictive device)
- IBM-PC/AT (LAPTOP) compatible software module

This software module is implemented at the level of IBM-PC/AT (LAPTOP) compatible software module and carries out the user interface, communication with PC-03, with a view to acquiring the data, to displaying, storing, processing, drafting the documents and to analyzing the data.

The user interface is interactive and suggestive for the user. Information processing and displaying can be done in real time. The user interface is implemented by means of the development environment VisualC++.

The software module at the level IBM-PC/AT carries out also data transfer from PC-03; a master/slave data protocol, organized per communication packages, is implemented.

The planned objective was achieved and finalized as „Study on the analysis of software application for the control of the vibratory stress relief equipment"

Got results: Study – 1 pc.

Activity II.5 Achievement of functional model for magnetostrictive vibrator

Within the framework of the activity II.5, the functional model of the magnetostrictive vibrator was achieved in accordance with the technical execution documentation from the activity II.1 The planned objective was achieved and finalized as „Functional model of magnetostrictive vibrator”

Got result: Functional model – 1 pc.

Activity II.6 Achievement of hardware structure for the control of the functional model

Within the framework of this activity, the hardware structure was achieved in accordance with the design from the activity II.3.

The planned objective was achieved and finalized as „ Hardware structure for the control of the functional model”

Got result: Model functional – 1 pc.

Activity II.7 Implementation of software application for the control of the functional model

Within the framework of this activity, the software application for controlling the functional model of the magetostrictive vibrator was achieved.

The program displays continuously the current values of the purchased analog input channels. It is offered the possibility of achieving a record of the sampled values for analog channels; these values will be stored depending on the value of the input signal frequency. The stored samples will be saved in a file which can be accessed by this program with a view to visualizing the graphs associated to these records.

The planned objective was achieved and finalized as „Software application for the control of the functional model”

Got result: Software– 1 pc.

Activity II.8 Experimentation of the functional model

Within the framework of this activity, experiments on the magnetizing coil and experiments on the functional model of the vibratory stress relief equipment, with magnetostrictive vibrator, were performed,
The planned objective was achieved and finalized as „Experiments on the functional of magnetostrictive vibrator”

Got result: Test report – 1 pc.