ROTOR BALANCING WITH VIBROMATRIX MACHINE

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ABSTRACT

The balancing is a method by which the distribution of the mass of a rotor is checked. This is corrected so that the vibration of the bearing spindles and of the bearing forces to be within the prescribed limits.

VibroMatrix turns PCs, notebooks and also netbooks into vibration measuring instruments with real-time graphic. VibroMatrix offers finished software for vibration measurement.

The paper presents the steps for balancing a rotor using InnoBalancer module of VibroMatrix machine.

KEYWORDS: balancing, vibration, InnoBalancer, counterweight

1. INTRODUCTION

The balancing is a method by which the distribution of the mass of a rotor is checked and, if necessary, is adjusted so that the vibration of the bearing spindles and / or the bearing forces to be within the limits prescribed for a corresponding speed rate of operation [2].

There are 2 types of balancing:
Dynamic Balancing;
Static Balancing;
a) Dynamic balancing of the rotor

Dynamic balancing of the rotor consists cancellation twister components of inertial forces to eliminate their harmful effects.

Form any rotor must be designed to fulfill these conditions. However, due to processing errors, the rotor may result practically with some deviations of the center of mass position, or the position of the central main axis of inertia with respect to the considered ideal.

The correction of these deviations is balanced by machines or special devices, the rotors are involved in rotation.

b) Static balancing of rotors

Static balancing of rotors is even more important as the rotor speed is greater (n>1500 rot/min); the rotor plane on which the diameter is greater than 10 times the width; it is practically sufficient static balance (bringing the centre of mass to the rotation axis).

The static balancing of a rotor whose center of gravity is offset can be done in one of the modes [1]:

- the additional mass is added on the opposite side of the imbalance at a fixed distance from the axis of rotation;

- practiced a hole to remove a mass of material.

The same principle is used to drive balanced VibroMatrix from InnoBeamer.

2. VIBROMATRIX MODULES

Measuring machine tools are easy to use VibroMatrix users.

These tools appear on the PC or notebook to which the machine is connected.

In their functionality, they are similar to traditional instruments. But often they are more powerful and above all, the data is immediately where we need it: on our computer.

The VibroMatrix instruments can be used in different combinations to fulfil the various tasks of vibration measurement [3].

All instruments work simultaneously and in real-time. Numerous vibrations measured, parameters and units are supported.

Measuring instruments offered are the following (Fig. 1):

- InnoMeter
- InnoPlotter
- InnoLogger
- InnoScope
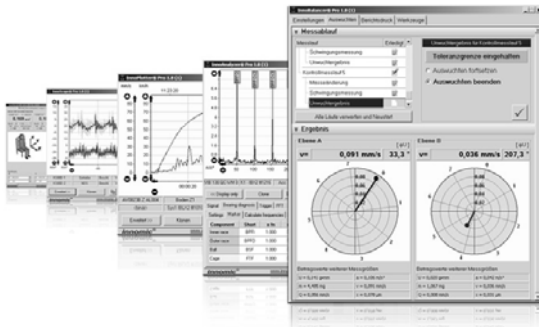
- InnoAnalyzer
- InnoAnalyzer Speed
- InnoBalancer

Fig. 1. *Measuring instruments of VibroMatrix*

2. INNOBALANCER MODULE

The InnoBalancer module is used to reduce vibrations [3].

Rotating moving parts of component machine tools, pumps, fans and other technical products can be cause vibration when they are not balanced.

InnoBalancer module assist the user in the process of balancing meaning that unbalances which produce vibrations are reduced significantly.

First, the most important rotor data are introduced in a control panel.

Then open the control panel "balancing" which contains steps to be followed in order to balance.

For alternative rotation speed rotors, InnoBalancer performs analysis of optimal rotation speed balancing to prevent a balancing at the resonance rotation speed.

The software is facilitating the automatic recognition of rotation speed and also accurately reads the vibration vectors.

On this basis is calculated the unbalances and also give suggestions to the size and position of balancing masses.

If these suggestions are not followed, the consequences are shown in a graph.

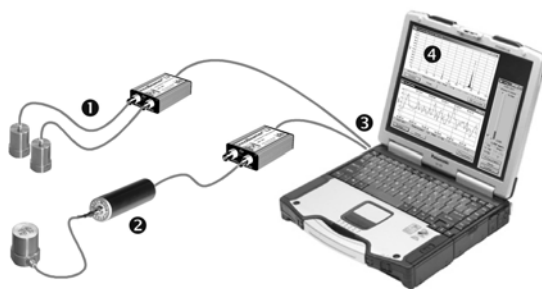The components of the measurement system are (Fig. 2):

Fig. 2. *Measurement system InnoBalancer*

1 - InnoBeamer (vibration sensors) with USB adapter

2 - Secondary sensor that converts data read in ICP1x0-series and thus transmits the signal to PC

3 - InnoBeamer connected to PC interface. PC power supplies InnoBeamer so no external power supply required.

4 - Software tools required different measurement applications.

Operation VibroMatrix is relatively simple because the system is assembled in a natural way signal transmission: sensor → measuring channel → instruments. Control Panel software's is modeled after this route (Fig. 3).
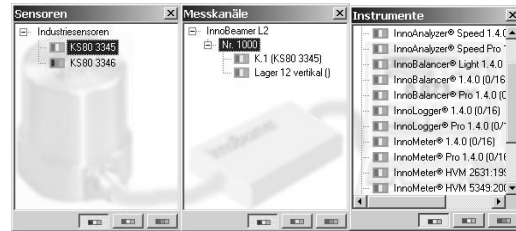

Fig. 3. *Control panel software*

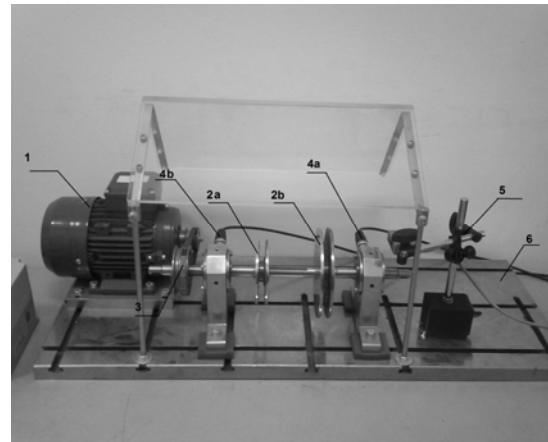5 - The active part of the balancing machine (Fig. 4), composed of:

Fig. 4. *The active part of the balancing machine*

1. – Electric motor

2 a,b - flywheels (balancing planes)

3. - Belt

4 a,b - InnoBeamer sensors; transferring the sensor signals to the PC/Notebook is carried out without loss as a permanent data stream.

5. - Measured speed sensor

6. - The frame of the machine

7 - The control panel (Fig. 5) regulates engine speed and his strength.

Fig. 5. *Control panel*

8 - InnoBeamer adapter (Fig. 6); converts the information read from sensors in computer readable information.

Fig. 6. *InnoBeamer adapter*

3. BALANCING OF A ROTOR

For a rotor balancing the following steps:
- Install software on PC
- Creating a new group of sensors, after which the two sensors are installed according to their existing code (Fig. 7).
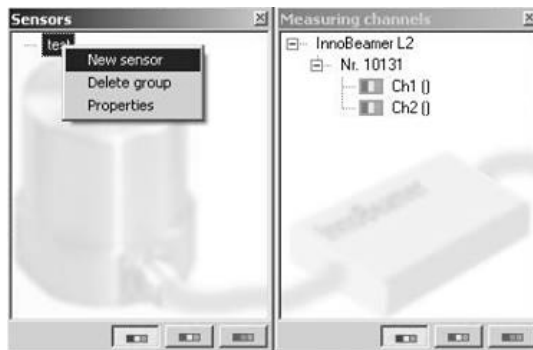

Fig. 7. *Definition of sensors*

- Enter data flywheels (diameter, no. of holes, hole diameters)
- Run the program to determine imbalances flywheels; after the first run the equipment will indicate the position and mass of the counterweight needed to balance the flywheel of the plane A (Fig. 8), and after the second run, for plane B (Fig. 9).
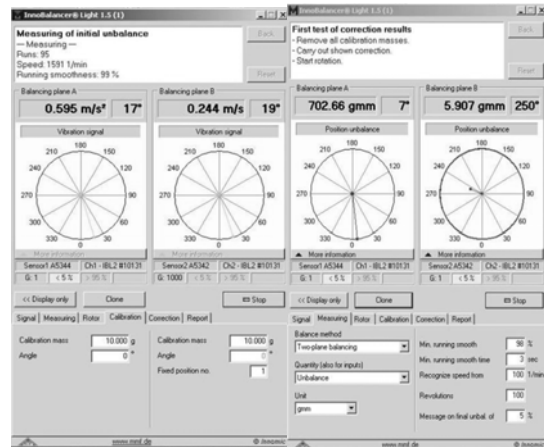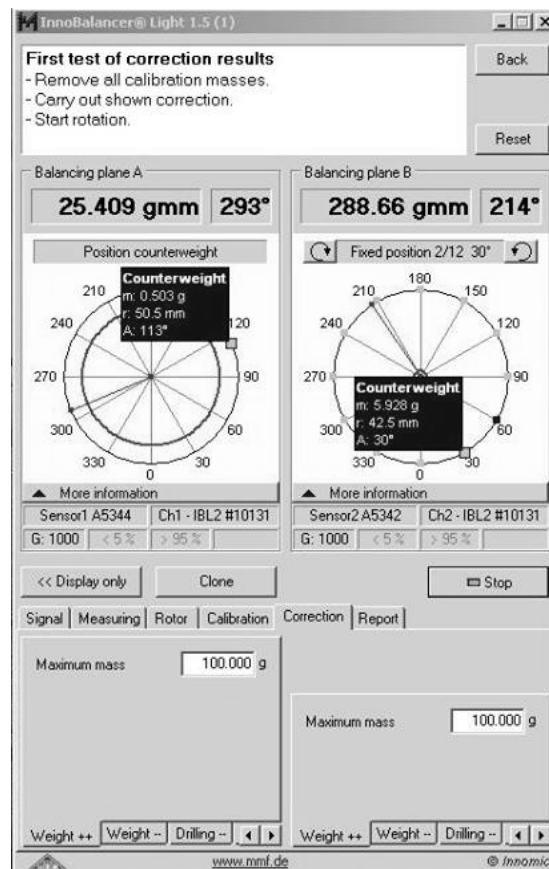

Fig. 8. The first run of the program

Fig. 9. *The second run of the program*

- Install the counterweights and running the program again to check if there are imbalances (Fig. 10).
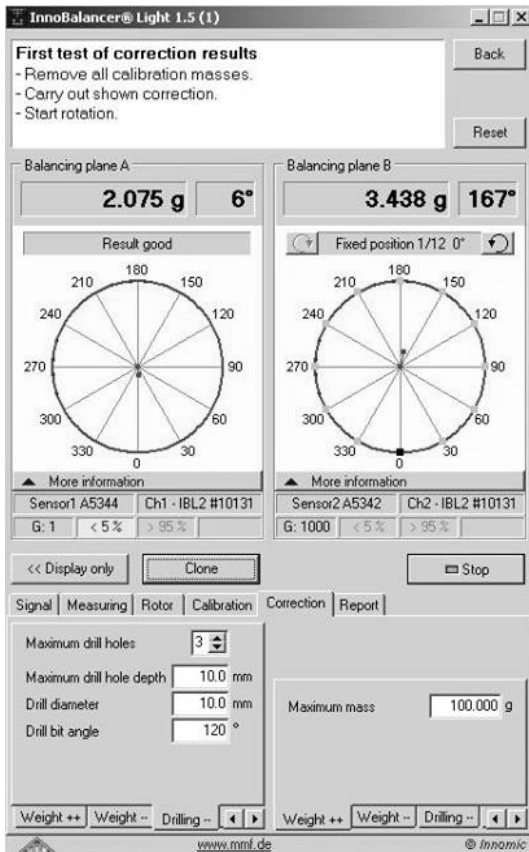
Fig. 10. *Running the program to confirm balancing*

Balancing of the rotor results are given in the Table 1. After the second test corrections, results size

and position of counterweights necessary for balancing the rotor.

Table 1. *First and second test of corrections*

Balancing plane	Initial unbalance	First test of correction	Second test of correction	
			Position	Mass
A	17^0	17^0	113^0 r=50,5 mm	0,503 g
B	19^0	250^0	30^0 r=42,5 mm	5,928 g

4. CONCLUSIONS

The InnoBalancer module is designed for the reduction of vibrations.

With the tools provided by VibroMatrix turn PCs into a vibration measuring instrument with graphics in real time.

VibroMatrix measurement system is useful for balancing rotating bodies, machines and industrial equipment.

VibroMatrix has also software instruments for special vibration measurement: human body, ships, building, wind turbine etc.

REFERENCES

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