INŽENÝRSKÁ MECHANIKA 2005
NÁRODNÍ KONFERENCE
s mezinárodní účastí
Svratka, Česká republika, 9. - 12. května 2005

ROTOR BALANCING ON VIBRATING BASE

P. Frankowski[1], T. Jarzyna

Summary: *In this work there has been made an attempt to evaluate the influence of the base surface vibrations on the rotor balancing. Tests were made on a laboratory stand where an unbalanced rotor with drive was fixed on a flexible base, whose vibrations were forced by a heating inductor within frequency range from 5 to 20 Hz. In paper were tested influence of frequency and amplitude base vibrations on possibility of rotor balancing.*

Introduction

Harmful impact of vibrations on devices and machines and technological processes accuracy is commonly known.

Reasons of machine vibrations are of different nature. Most frequently they occur in result of not balancing the vibrating elements therefore their balancing is of great importance both in the machine and their subassembly production process and during their operation and maintenance.

Balancing is frequently performed in the machine exploitation place. If the base on which the machine stands is immovable then balancing is relatively easy. However, if the device in question is part of a larger installation which can not be turned off then the base surface is a source of kinematic forces of different values frequencies amplitudes. In such cases balancing is very difficult.

In this work there has been made an attempt to evaluate the influence of the base surface vibrations on the rotor balancing.

Tests methods

Tests were made on a laboratory stand (fig.1) where an unbalanced rotor with drive was fixed on a flexible base, whose vibrations (amplitude and frequency) were forced by a heating inductor. For applying forces an oscillator of Svantek Svan 401firm was used. Balancing was performed with the use of portable balancer Rotortest 03 of Cimat firm.

[1] Eng. Paweł Frankowski, Eng. Tomasz Jarzyna, Department of Applied Mechanics, Faculty of Mechanical Engineering, University of Technology and Agriculture in Bydgoszcz, 85-791 Bydgoszcz, Prof. S. Kaliskiego 7, Poland, e-mail: pawfra@atr.bydgoszcz.pl

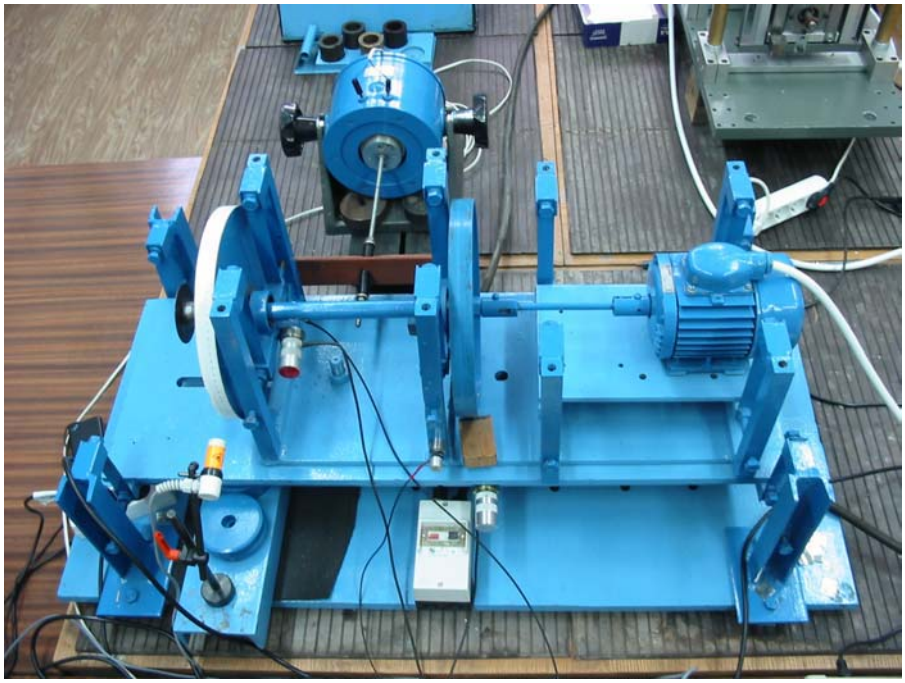

Fig 1. Research stand picture

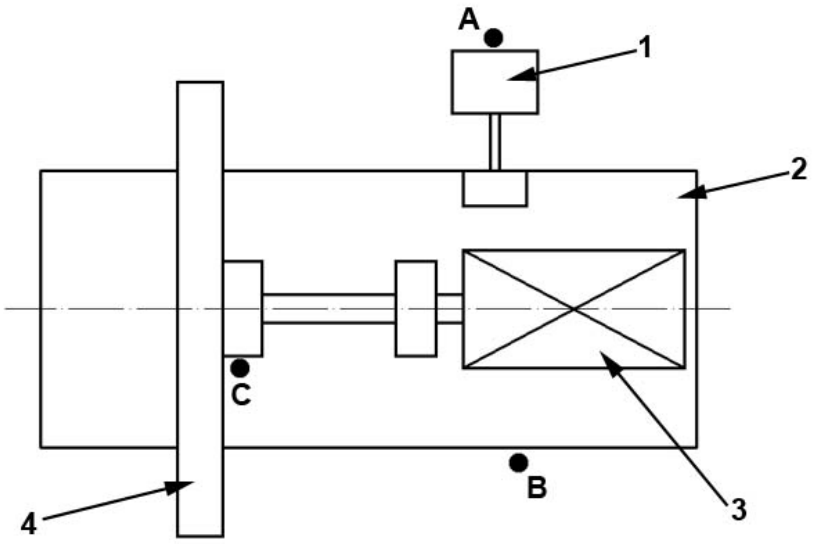

Fig 2. Scheme of research stand. 1 – heating inductor; 2 – flexible base; 3- electric motor; 4 – rotor; A, B, C – vibration measure points.

Rotational speed of rotor was established on 1068 rpm, which is equal frequency f=17,8Hz. Rotor of research stand was balanced. Unbalancing equal 4440 gmm and unbalancing degree – 213º were affirmed. After that heating inductor was started and frequency of vibration force was changed. Generated vibration frequency of base was changed from 5 to 20 Hz, amplitude was constant and equal 1mm. For different frequencies of base vibrations was trying to balancing of rotor. During balancing unbalancing and

unbalancing degree were registered. Amplitude, speed of vibration and acceleration of vibration were also registered.

Tests results

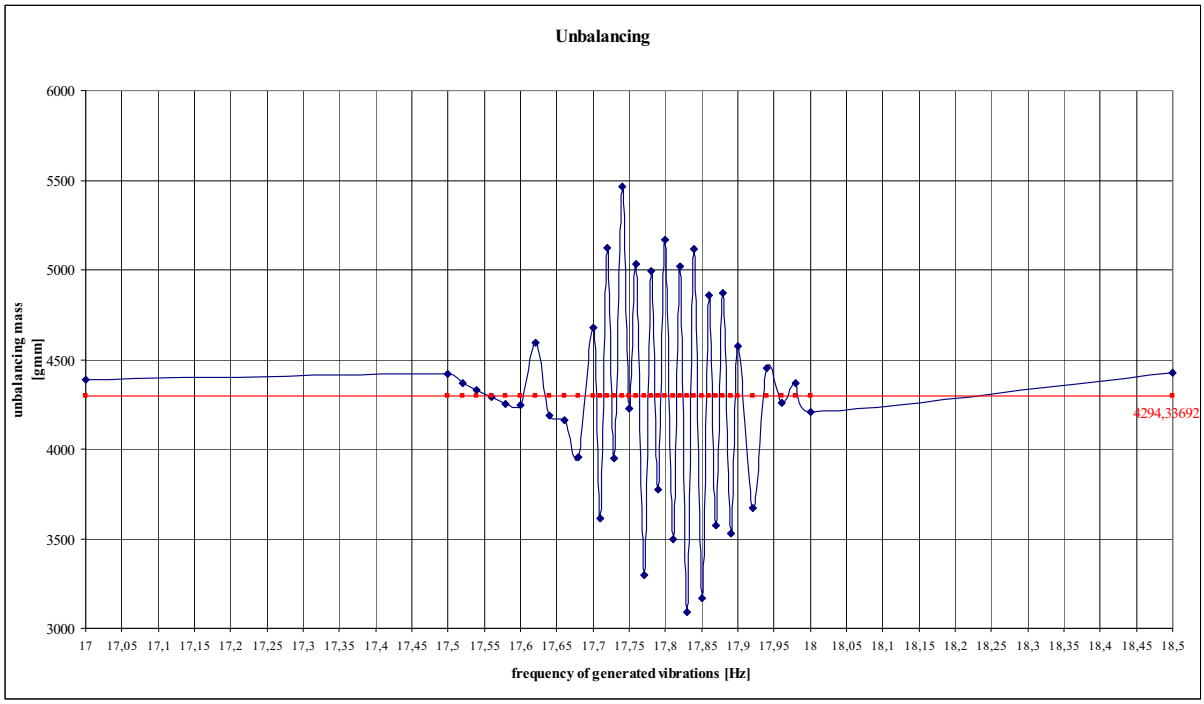

Chart 1. Unbalancing vs. base frequency

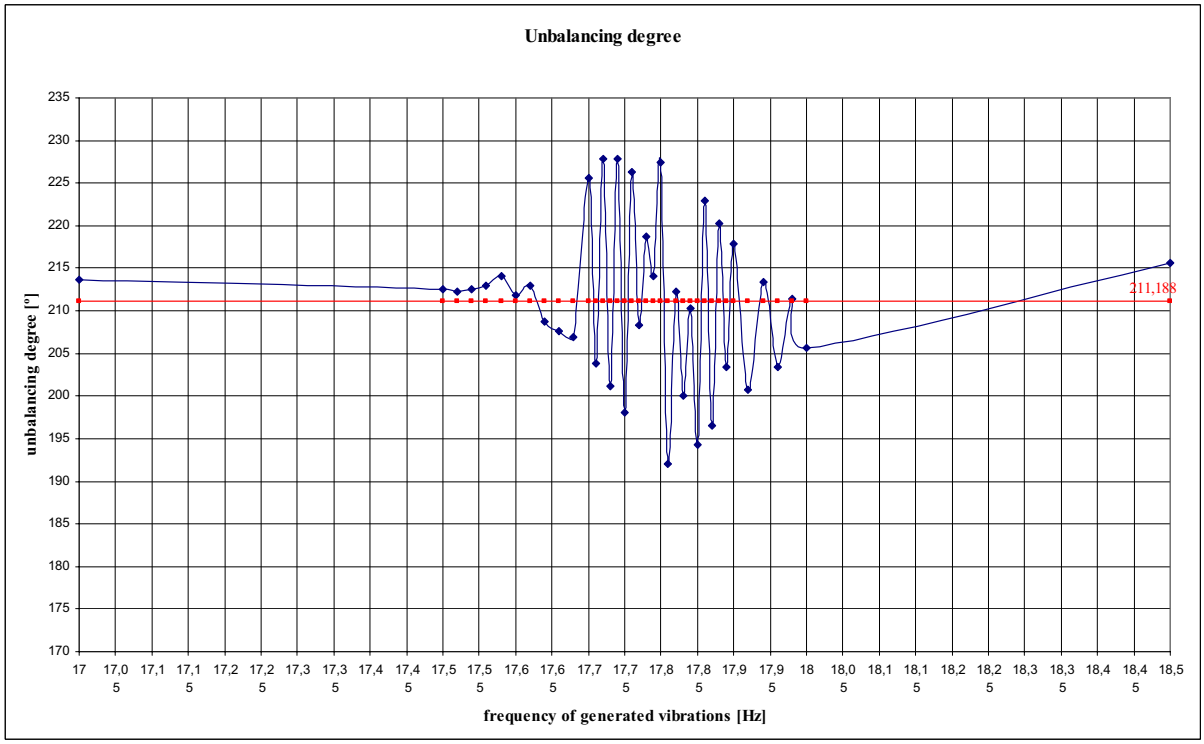

Chart 2. Unbalancing degree vs. base frequency

Research of influence of base vibration on balancing process was started from force frequency 5Hz. The frequency was increased for 0,5 Hz. Possibility of balancing of rotor in frequency range from 5Hz to 17,6 Hz and from 18Hz to 20 Hz was affirmed in tests. Unbalancing and unbalancing degree are not much different from average value in these range and difference is in measure error. For vibration frequency of base almost equal to frequency of rotational speed (17,8 Hz) object balancing was impossible. Tests results are showed on charts (chart 1, chart 2). For increase legibility the range of frequency was limited into 17 Hz to 18,5 range.

In range from 17,6 Hz to 18 Hz the unbalancing (chart 1) and unbalancing degree (chart 2) were considerably different from average value. Difference between average value of unbalancing and particular test result was closed from 10 gmm to 1170 gmm. Difference between average value of unbalancing degree and particular test result was closed from 0º to 20º.

Conclusions

1. Balancing of rotors is possible for base frequency of base different then frequency of rotor.
2. When frequency of rotor are nearing to frequency of rotary motion, the beat effect is appeared and balancing is impossible. Is was in range about 1 Hz.
3. In troubles with balancing of rotors rotary speed should be changed.
4. For better understand problems connecting with rotor balancing on vibrating base is analytically analysis of dependences.

References

Hassan G. A. (1995) New approach for computer-aided static and dynamic balancing of rigid rotors. *Journal of Sound and Vibration* Volume: 179, Issue: 5, February 2, pp. 749 –761

Kim, Jong-Soo; Lee, Soo-Hun (2003) The stability of active balancing control using influence coefficients for a variable rotor system. *The International Journal of Advanced Manufacturing Technology* Volume: 22, Issue: 7-8, November, 2003, pp. 562 – 567

Xu B., Qu L., Sun R. (2000) The optimization technique-based balancing of flexible rotors without test runs. *Journal of Sound and Vibration* Volume: 238, Issue: 5, December 14, pp. 877 – 892

Sève, F.; Andrianoely M.A.; Berlioz A., Dufour R.; Charreyron M. (2003) Balancing of machinery with a flexible variable-speed rotor. *Journal of Sound and Vibration* Volume: 264, Issue: 2, July 3, 2003, pp. 287 – 302