DOI 10.36074/11.12.2020.v2.04

FORMATION OF VIBRATION ACCELERATIONS IN THE VERTICAL DIRECTION IN THE CARGO TROLLEY TRAVEL WHEEL

ORCID ID: 0000-0002-5449-3512 **Evgen Slepuzhnikov**
PhD, lecturer department of special chemistry and chemical technology
National university of civil defence of Ukraine

ORCID ID: 0000-0003-2862-7131 **Iryna Avdieienko**
PhD, associate professor of english language school of foreign languages
Kharkiv National University V.N. Karazin

SCIENTIFIC ADVISER:

ORCID ID: 0000-0002-5248-273X **Nataliia Fidrovska**
Doctor of technical sciences, professor,
professor department of building and road cars
Kharkiv national automobile and road university

Ukraine

Bridge cranes are the most widely used hoisting machines in modern production, ensuring their reliable and uninterrupted operation is a very important task [1, 2].

The durability of the bridge crane depends largely on the durability of its metal structure, which receives quite significant variable loads [3, 4]. Cyclic operation of the crane causes rapidly changing processes of loads not only in time but also in magnitude [5]. This requires a very careful determination of all power factors that occur during the operation of the bridge crane, both static and dynamic [6].

The main loads that occur in the metal structure of the bridge crane, occur during lifting and operation of the mechanisms of movement of the truck and the bridge [7, 8]. Many works have been devoted to the assessment of the influence of structural parameters of movement mechanisms on dynamic loads in metal structures [9, 10].

We proposed a new design of the running crane wheel with an elastic insert [11, 12], which significantly reduced the dynamic loads during the operation of the movement mechanism [13].

The «Ultra-B-I» complex was used to measure the vibration accelerations that occur during field tests of the bridge crane trolley (Fig. 1).

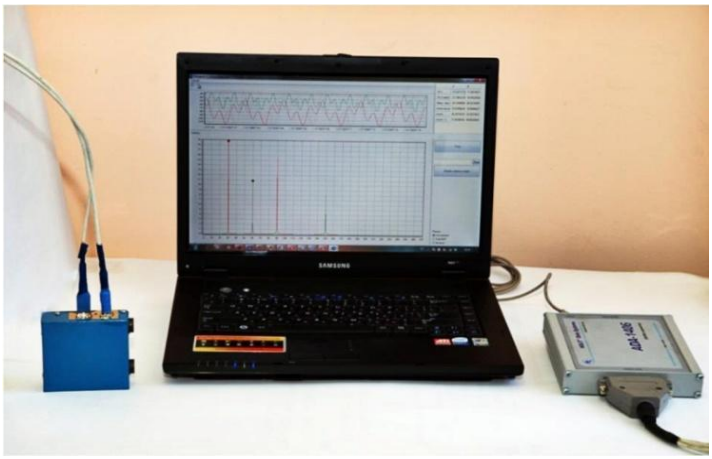

Fig. 1. **General view of the vibration measuring complex «Ultra-B-I»**

The software that is part of the vibration measuring complex allows you to build in real time the dependence of vibration accelerations on the frequency, as well as to determine the spectral composition of the signal.

The research was conducted on an existing bridge crane. The vibration measuring complex was located directly on the object of research. The sensors were installed at the control points of the crane truck and were connected to the analog-to-digital converter by means of wires placed on the crane beam. The latter allowed for direct control over the modes of operation of the crane.

The study of the vibration state was carried out on the axis of the driven regular running wheel of the cargo crane of the bridge crane and on the axis of the driven modernized running wheel of the cargo crane of the bridge crane.

Vibration measurements were performed at different speeds of the trolley on the crane bridge, as well as at different operating modes.

References:

[1] Haniszewski, T. (2017). Modeling the dynamics of cargo lifting process by overhead crane for dynamic overload factor estimation. Journal of Vibroengineering, 19 (1), 75–86. doi: https://doi.org/10.21595/jve.2016.17310

[2] Castro, J. C., Palafox, E. H., Gómez, L. H., Mendoza, G. S., Grijalba Y. L., López, P. R. (2019). Analysis of the structural girders of a crane for the license renewal of a BWR Nuclear Power Plant. Procedia Structural Integrity. Vol. 17, 115–122. doi: https://doi.org/ 10.1016/j.prostr. 2019.08.016

[3] Yifei, T., Zhihao, G., Xingcheng, Z., Guomin, S., Dongbo, L., Xiangdong, L. (2018). Research on welding deformation for box girder of bridge crane based on thermal elasto-plastic theory. Advances in Mechanical Engineering. Vol. 10 (5), 1–12. doi: https://doi.org/10.1177/ 16878140187758 85

[4] Spruogis, B., Jakstas, A., Turla, V., Iljin, I., Sesok, N. (2011). Dynamic reaction forces of an overhead crane on lifting. TRANSPORT. Vol. 26 (3), 279–283. doi: https:// doi.org/10.3846/16484142.2011.622144

[5] Qin, Y., Jiang, J., Yang, H. (2016). High precision analysis of stress concentration in girder structure of casting crane. International Journal of Science and Qualitative Analysis. Vol. 2 (2), 14–18. doi: https://doi.org/10.11648/j.ijsqa.20160202.11

[6] Kutsenko, L., Vanin, V., Shoman, O., Yablonskyi, P., Zapolskiy, L., Hrytsyna, N., Nazarenko, S., Danylenko, V., Sivak, E., Shevchenko, S. (2019). Modeling the resonance of a swinging spring based on the synthesis of a motion trajectory of its load. Eastern-European Journal of Enterprise Technologies. Vol. 3/7 (99), 53–64. doi: https://doi.org/10.15587/1729-4061.2019.168909

[7] Kutsenko, L., Semkiv, O., Kalynovskyi, A., Zapolskiy, L., Shoman, O., Virchenko, G., Martynov, V., Zhuravskij, M., Danylenko, V., Ismailova N. (2019). Development of a method for computer simulation of a swinging spring load movement path. Eastern-European Journal of Enterprise Technologies. Vol. 1 (7), 60–73. doi: https://doi.org/ 10.15587/1729-4061.2019.154191

[8] Kutsenko, L., Vanin, V., Shoman, O., Zapolskiy, L., Yablonskyi, P., Vasyliev, S., Danylenko, V., Sukharkova, E., Rudenko, S., Zhuravskij, M. (2019). Synthesis and classification of periodic motion trajectories of the swinging spring load. Eastern-European Journal of Enterprise Technologies. Vol. 2 (7), 2–37. doi: https:// doi. org/ 10.15587/1729-4061.2019.161769

[9] Meng, W., Yang, Z., Qi, X., Cai, J. (2013). Reliability analysis-based numerical calculation of metal structure of bridge crane. Mathematical Problems in Engineering. Vol. 1 (5), 1–5. doi: http://dx.doi.org/10.1155/2013/260976

[10] Haniszewski, T. (2014). Strength analysis of overhead traveling crane with use of finite element method. Transport problems. Vol. 9 (1), 19–26. https://www. researchgate.net/publication/276235576

[11] Фідровська, Н. М., Слепужніков, Є. Д., Чернишенко, О. В. (2015). Міцність трьохшарової циліндричної оболонки. Науковий вісник будівництва. Вип. 1 (79), 190–193. http://repositsc.nuczu.edu.ua/handle/123456789/7456

[12] Фідровська, Н. М., Слепужніков, Є. Д. (2012). Визначення оптимальних параметрів ходових коліс мостових кранів. Науковий вісник будівництва. Вип. 69, 215–222. http://repositsc.nuczu.edu.ua/handle/123456789/7436

[13] Fidrovska, N., Slepuzhnikov, E., Larin, O., Varchenko, I., Lipovyi, V., Afanasenko, K., Harbuz, S. (2020). Increase of operating reliability of the travel wheel using the use of the elastic inserts. EUREKA: Physics and Engineering. 5 (30), 69–79. DOI: 10.21303/2461-4262.2020.001387