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InterPartner 2020

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2nd Grabchenko's International Conference on Advanced Manufacturing Processes

September 8-11, 2020 | Odessa, Ukraine

Book of Abstracts

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Editors:

Volodymyr Tonkonogyi, Vitalii Ivanov, Ivan Pavlenko, Oleksandr Liaposhchenko

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Recommended by Coordination Board of International Association for Technological Development and Innovations (Protocol No. 11, August 14, 2020)

This book covers topics at the interface between manufacturing, materials and mechanical engineering, as well as quality assurance, with a focus on advanced manufacturing processes. It focuses on the recent developments in production planning, design engineering, advanced materials, manufacturing technology, machining processes, process engineering, quality assurance. It covers a wide range of manufacturing processes, such as cutting, grinding, assembly, coatings, including ultrasonic treatment, molding, radial-isostatic compression, ionic-plasma deposition, volumetric vibration treatment, wear resistance, highlighting the advantages of augmented reality, RFID technology, reverse engineering, optimization, heat and mass transfer, energy management, quality inspection, and environmental impact. Based on the 2nd Grabchenko's International Conference on Advanced Manufacturing Processes (InterPartner-2020), held on September 8-11, 2020, in Odessa, Ukraine, this book offers a timely overview and extensive snapshot on trends and technologies in the significant areas of engineering. It is also intended to build a bridge between academic and industrial researchers.

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Synthesis of Elastic Characteristics Based on Nonlinear Elastic Coupling

Victor Kurgan[0000-0003-3153-7313],
Ihor Sydorenko[0000-0003-1840-4313],
Ihor Prokopovich[0000-0002-8059-6507],
Yuriy Yeputatov[0000-0002-6984-0353],
Oleksandr Levynskyi[0000-0001-9643-1494]

Odessa National Polytechnic University, 1, Shevchenko Ave, Odessa, 65044, Ukraine

Modern equipment and units operate in a wide range of loads, amplitudes, and vibrational frequencies caused by harmonic, shock, or external influences. On this basis, it is urgent to develop new designs with advanced capabilities to counteract torsional vibrations in the technical system. The design of elastic coupling with nonlinear mechanical feedback is considered in the paper. Developed its design scheme and the main geometrical parameters that determine the elastic characteristic. Expressions were obtained which describing the elastic characteristic of the coupling. Calculations have been made to evaluate the capabilities of the considered device to reproduce nonlinear elastic characteristics. The control function as a step polynomial was used to determine the relationship between the curvature of the control function sections and the relevant sections of the elastic characteristic. A graphical interpretation of the calculations is made. The initial parameters are determined, and the target elastic characteristic with two sections of temporary load loss is calculated. The graphical interpretation showed that the elastic coupling realizes the calculated elastic characteristic. A correction parameter is set to prevent the mechanism from being jammed when using complex control link profiles.

Volodymyr Tonkonogyi
Vitalii Ivanov
Ivan Pavlenko
Oleksandr Liaposhchenko

2nd Grabchenko's International Conference on Advanced Manufacturing Processes (InterPartner-2020)

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International Association for Technological Development and Innovation
5, Mykhayla Lushpy Ave., 30/29, Sumy, 40035, Ukraine
E-mail: info@iatdi.org

The primary goal of the **2nd Grabchenko's International Conference on Advanced Manufacturing Processes (InterPartner-2020)** is to promote research and development activities, to intensify scientific information interchange between researchers, developers, engineers, students, and practitioners working in and around the world. The conference is an ideal platform for people to share views, experience, and knowledge in Engineering related areas. The working language of the conference (including conference proceedings, presentations, and discussions) is **English.**

Interpartner-2020 is under the patronage of the honorary chair of Conference **Prof. Anatoliy Grabchenko,** Rector of Odessa National Polytechnic University **Prof. Gennadii Oborskyi,** Rector of National Technical University «Kharkiv Polytechnic Institute» **Prof. Yevhen Sokol** and Rector of Sumy State University **Prof. Anatoliy Vasylyev**

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Contacts

1, Shevchenko Ave., Odessa, 65044, Ukraine
interpartner.odessa.ua
vmt47@ukr.net

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Victor Kurgan, Ihor Sydorenko, Ihor Prokopovich, Yuriy Yeputatov, Oleksandr Levynskyi

Odessa National Polytechnic University

Synthesis of Elastic Characteristics Based on Nonlinear Elastic Coupling

In modern engineering, elastic couplings with metal elastic elements have become widespread. This is facilitated by the ability of these devices not only to transmit torque, but also to prevent negative manifestations of oscillations in the technical system. In studies using mathematical models it has been found that the most positive results are shown by elastic couplings with nonlinear elastic characteristics. However, elastic couplings that have already been created do not fully meet the stated requirements, due to their narrow operating range.

Consider a perspective design of a non-linear mechanical coupling elastic coupling. For drawing up of the calculation scheme, we analyze the functional interaction between the coupling elements in the process of operation (Fig. 1).

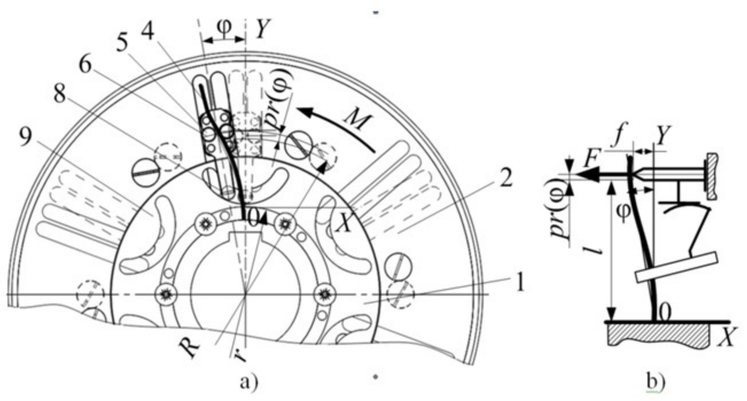

Fig. 1. Calculation scheme of elastic coupling with non-linear mechanical feedback: general (a); simplified (b).

Based on the defined calculation scheme and taking into account the presence of additional mechanical structure, the expression is obtained which determines the adjustable elastic characteristic of the proposed elastic coupling.

To evaluate the capabilities of the device in relation to the reproduction of elastic characteristics, a series of calculations was performed.

In order to determine the relationship between the curvature of the sections of the control function and the corresponding sections of the elastic characteristic, the control function, which was given in the form of a step polynomial, was applied.

Based on the results obtained, the possibility of reproducing the proposed elastic coupling of the target elastic characteristic was calculated

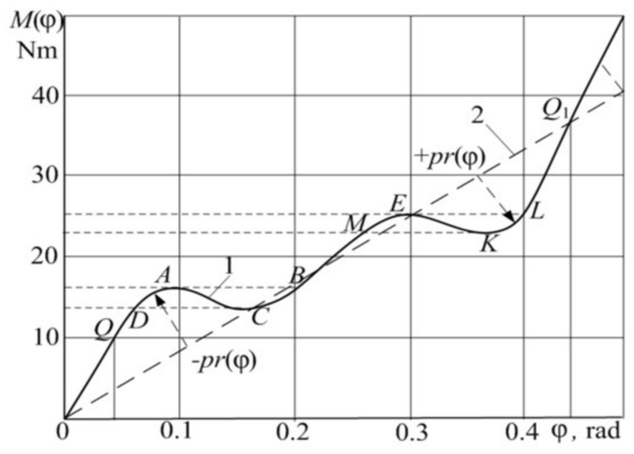

Fig. 5. Formation of the target elastic characteristic.

Validation of pressure angles points using the built-in CAD package of the Autodesk Inventor Series kinematics module showed that in some sections of , the angle of pressure exceeds or is equal to 45º, so jamming is possible in these sections.

In order to prevent this phenomenon, the geometric indices of the curvilinear groove were optimized (increasing the radius of the middle arc). At the same time, a correction parameter was set, which, taking into account the input data, is equal to *Kor* = 20 mm.

- Based on the studies, it was found that the synthesis of the adopted target elastic characteristics indicates the significant capabilities of the proposed device for the reproduction of the necessary, according to certain requirements, elastic characteristics
- In the synthesis of complex elastic characteristics, the geometric parameters of the additional mechanical structure should be controlled by contact interaction to prevent jamming phenomena.
- The calculation of the correction, given the magnitude of the pressure angle, of the parameter *Kor* indicates that in some cases the radial size of the device, to fully reproduce its functionality can be increased.

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Victor Kurgan PhD,
Institute of Mechanical Engineering and Transport,
Odessa National Polytechnic University
1, Shevchenko St., Odessa, 65044, Ukraine;
E-mail: kurgan@opu.ua

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