

Characteristics of polymer ring springs

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Abstract

Statement of the Problem: The unavoidable surface friction requires special consideration at the stage of formulating the design goal, since it can affect not only the elastic, but also damping properties, including self-braking. The scope of the study included models representing a class of springs, the originality of which is due to the association of their relatively uncommon, conical-ring form, with polymeric materials of spring elements, which leads to original elastic-damping properties. The result is qualitatively and quantitatively different performance characteristics, shaping their specifics. The decisive differences arise from strength, thermal, technological properties, including price.

Methodology & Theoretical Orientation: A preliminary study was undertaken to identify the influence of the type of materials and their associations, as well as the basic dimensions - diameters and angles of conical surfaces, on the characteristics of mating ring pairs. Static and dynamic tests were performed. The built numerical model was validated in terms of compatibility of elastic properties with the studied material models.

Findings: Analytical models have been developed, as tools to support the design processes of ring spring structures, in the field of innovative material solutions. They are a tool for the selection of geometric and material characteristics of springs, meeting the set operational expectations. The experiments conducted on material and numerical models confirmed the correctness of the models and their usefulness in the design and manufacturing process of the studied elastic systems.

Conclusion & Significance: The results provided clues to the purposeful area of design exploration of the studied systems. They also confirmed the effectiveness of the adopted tools and research methods.

Image

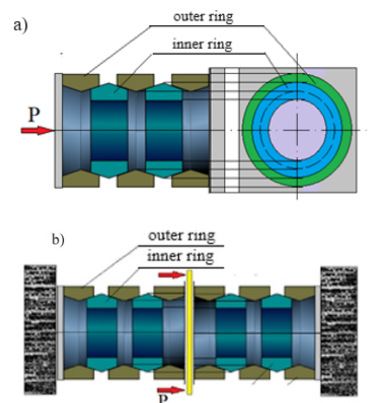


Figure 1: Examples of single-sided ring spring (a) and system of 2-sided ring springs (b).

Recent Publications

1. Wróbel G.: Characteristics of polymer ring springs. Archives of Materials Science and Engineering. 2022; 114 (1): 13-23
2. M. Radeş, Editor-in-Chief: S. Brown: Shock isolation systems. Encyclopedia of Vibration, 2001.
3. Yuhong Ling, Shan Wu, Jingxin Gu and Hongtao Lai: A Novel Ring Spring Vibration Isolator for Metro Superstructure. Appl. Sci. 2021, 11, 8422 <https://www.mdpi.com/2076-3417/11/18/8422/htm>
4. P. Borkowski, G. Krzesiński, P. Marek, T. Zagrajek: Finite Element Method in mechanics of materials and structures. Solving selected problems with the ANSYS system. Publisher: Publishing House of the Warsaw University of Technology. 2022. 2nd Edition. Warsaw. (in Polish)
5. W. Szlezynger, Z. Brzozowski: Plastics. T. I. Wydawnictwo Oświatowa FOSZE. 2023. (in Polish)

Photograph



Biography

Prof. Gabriel Wróbel tied his professional career to the Silesian University of Technology, having been a teaching and research employee at the Faculty of Mechanical Engineering since 1975. His areas of interest include issues of mechanics, mechanical engineering, strength of materials and materials engineering. He has several hundred publications to his credit, which are the result of experience gained in scientific work, but also from cooperation with industry. He is the author of many forensic reports. Over the years, he has organized and chaired many scientific conferences on the topics of technology and mechanics of polymeric materials and composites.

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