Synthesis Lectures on
Mechanical Engineering

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Anton Panda · Volodymyr Nahornyi

Monitoring Vibrations and Disturbances in Industry and Nature

Springer

Synthesis Lectures on Mechanical Engineering

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Anton Panda
Department of Automobile and Manufacturing Technology
Technical University of Košice
Prešov, Slovakia

Volodymyr Nahornyi
Sumy State University
Sumy, Ukraine

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Preface

The methodology is based on forecasting the individual state of the control object, which is carried out based on the analysis of the trend behavior of the controlled parameter. The purpose of this monograph is to present the new methodology for monitoring catastrophic processes in industry and nature.

The methodology is implemented in the form of a software product intended for a wide range of users, including manufacturers of various products, their consumers, as well as a wide range of people who come into contact with catastrophically developing processes in their professional activities.

The use of software in the technology of embedded control systems can radically increase the reliability of products, reducing the number of complaints to almost zero and thereby increasing their consumer properties. This circumstance excludes emergency (sudden) equipment stops, which often lead to man-made disasters. At the same time, repairs move from the category of restoration to the category of maintenance, with a simultaneous significant reduction in their number, an extension of the time between repairs, and an inevitable reduction in the consumption of spare parts.

The use of this technique in metalworking makes it possible to reduce the probability of defects in a manufactured part to a negligible value.

The presented methodology is especially in demand when operating products and structures that are unique or low-volume and for which there is no statistical data on the maximum permissible values of their controlled parameters.

The monograph provides a comprehensive presentation of information from data collection to their assessment. The monograph is useful for university teachers, and students of technical faculties who are interested in new approaches and trends in his area.

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Prešov, Slovakia — Anton Panda
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About the Authors

Prof. Ing. Anton Panda Ph.D., University studies—Faculty of Mechanical Engineering TU Košice (Ing.-1987); terminated doctoral studies—Faculty of Manufacturing Technologies TU Košice (Ph.D.-2002), Associate Professor of study branch 4.7.51 manufacturing technologies, FMT TU Košice (Assoc. Prof.-2008), Professor of study branch 4.7.51 manufacturing technologies, FMT TU Košice (Prof.-2015). 29 years of experience in the engineering company supplying the products for demanding automotive, also farm, and agricultural industries (constructor of special purpose machinery and equipment, systems analyst, head of the department of development and technical preparation of production, methodist of statistical methods, commercial and technical director, director of quality). In the present expertise and design activities in the area of development, production, and verification of rolling bearings, in the area of deposition with rolling bearings for various domestic and foreign customers. Since 2008 (since 1994 external) operates as a pedagogue and scientist at the Faculty of manufacturing technologies TU Košice with the seat in Prešov, as well as an expert—coordinator (auditor) of quality management systems. He is the author (co-author) of 20 monographs (14 foreign, six domestic)—of it six monographs in Springer publishing, three university textbooks (two foreign, one domestic), 16 university lecture notes, author's certificates (14), patents and discoveries (14), catalogs of bearings (2), several domestic and foreign original scientific papers in the scientific and professional journals, in Current Content Connect journals in Web of Science (21), in impacted journals and publications led in the world renowned databases (Thomson Scientific Master Journal List—Web of Science (Web of Science—123, Scopus—173) and in proceedings from domestic and foreign scientific conferences from the following areas: Automobile production, manufacturing technologies, experimental methods in the manufacturing technologies, machining, development, manufacturing and verification of new products in accordance with the standards EN ISO 9001 and in accordance to the specific requirement of automobile manufacturers IATF 16 949 (ISO/TS 16 949), quality control, statistical methods and techniques of quality for the production of part, capability of machine, capability of manufacturing processes, capability of gauges and

measuring equipment, technical preparation of production, product audit, system audit of quality management system, analysis of potential errors and their effect on construction (FMEA-K) and on manufacturing process/technology (FMEA-V), statistical regulation of manufacturing processes SPC, process of approval of part to the production PPAP, modern quality planning of product APQP, control plans and regulation, requirements the association of automobile manufacturers in Germany VDA 6.1, quality system requirements for suppliers of Ford, Chrysler, GM, specific requirements the using of EN ISO 9001:2015 in organizations ensuring the mass production in automotive industry ISO/TS 16949, method of Poka-Yoke, quality assurance before the mass production for suppliers of automobile manufacturers in Germany VDA 3.3, quality assurance of supplies for suppliers of automobile manufacturers in Germany VDA 2, product ability, method of Global 8D (8-step method for solving of problems), etc. At these works are registered the various domestic and foreign quotations and testimonials in the worldwide databases. Solver of several projects and grant projects for engineering companies at home and abroad, solver of research tasks, and author of the directives, methodological guidelines, technical regulations, and other technical documentation for domestic and foreign manufacturing companies. He is the auditor of quality system management at Technical University in Košice. Active collaboration with the university workplaces at home and abroad. He is recognized as an expert in the production of bearings in companies in Germany, Italy, China, Slovakia, and Czech Republic. As the coordinator of research collective and co-author of documentation, EFQM has won the Award for Improvement of Performance in the competition National Award of Slovak Republic for Quality in the year 2010 for the Technical University of Košice. In the same competition, he won the same award in the year 2012, when the Technical University of Košice obtained the highest score in its category. Since 2014 he has been a member of the Polish Academy of Sciences. Since 2014 he has a member of ASME, USA.

Volodymyr Nahornyi Ph.D., University studies—Faculty of Electronics and Information Technologies, Department of Computer Science, Section of Information Technology of Design, Sumy State University, Sumy, Ukraine (2006–2011); Master's degree in Information Technology of Design (2011); Dynamics and strength (Ph.D.-2015). Senior Lecturer in the Department of Computer Science, Section of Information Technology of Design in Sumy State University (2016–2022); Since 2022, Associate Professor in the Information Technology Department in Sumy State University. He is the developer (co-developer) of courses such as Mobile programming, Frontend development of SPA Web applications, and Software Product Development Technology. He is the author (co-author) of two monographs, author's certificates (3), patents and discoveries (8), 71 domestic and foreign original scientific papers in the scientific and professional journals, publications included in the world renowned databases (Thomson Scientific Master Journal List—Web of Science (Web of Science—14, Scopus—20)) and in proceedings from domestic and foreign scientific conferences from the following areas (26): Information technologies in

production, the determination of the individual resource of technical systems, the control of the dynamic behavior of metal-processing technological systems and the forecasting of their working time, the determination of the technical state of the systems.

Symbols

Ra	Average value of micro roughness height at base length
T_{RUL}	Value residual useful tool life
T_{ACT}^{RUL}	Actual value residual useful tool life
f	Feed speed
$r(t)$	Time-varying tool nose radius
r_0	Radius at the tip of a sharpened tool
r_{max}	Tool nose radius at the end of the linear wear
φ	Linear wear factor
ξ	Catastrophic wear factor
r_{min}	Minimum tool nose radius
α, β	Exponents
$\overline{E}$	Dimensionless value of the information signal registered at the i-th moment of the control object monitoring
$\overline{E}_{CR}^{ext}$	Value of information parameters recorded at the time of the accident (reaching the critical state of the control object)
$\overline{E}^{f}$	Factual recorded values of the information signal E reduced to a dimensionless form
$\overline{E}^{c}$	Computed values of the information signal E reduced to a dimensionless form
T_{CR}	Forecast model parameter
ψ, ϕ, ζ	Coefficients determined in the process of identifying a forecast model
τ	Forecast model argument
t_f	Moment of exacerbation
a	Actual exponent
$\alpha + \beta i$	Complex exponent
a_i	Polynomial coefficients
$F(\cdot)$	Some periodic function
τ	Size phase