A SOFTWARE AND HARDWARE SYSTEM FOR CONDITION MONITORING AND LIFETIME RESEARCH OF STATIONARY PROCESS EQUIPMENT IN HAZARDOUS PRODUCTION FACILITIES

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ABSTRACT

Software and hardware systems for condition monitoring and lifetime research, including a set of permanently installed ultrasonic transducers for guided wave testing, residual thickness measurements, acoustic emission measurements, eddy current transducers for crack development analysis, as well as a software system for collecting and processing information that takes into account the nature of technological processes and the criticality of mechanical, climatic, and other factors, enable the condition of process equipment in hazardous production facilities to be assessed. The transition to a limit state is determined by wear processes of individual components due to material aging, erosion, corrosion, response cycles, or operating time. Information on the technical (limit) condition of objects is obtained from the dynamics of the processes being studied, the availability of reliability data for analogs and prototypes (mean time between failures), and operating modes using diagnostic and monitoring methods, taking into account the life-span and strength studies conducted at the design stage. The described approach to ensuring safety for all stages of the life cycle of both technological objects and the monitoring systems themselves is adopted for the development of a rational technical policy for ensuring the safety of hazardous industrial complexes. High safety is achieved by using multiple systems that employ various technologies and safety strategies at all stages of the life cycle, taking into account changing conditions and the rapid development of technologies for both individual areas of application and their combinations. This provides advantages in terms of safety and economic feasibility. Technical diagnostic and condition monitoring systems use various models for standard and normal conditions, hazardous and emergency situations during operation, and extremely hazardous situations. The transition from standard (normal) to limit states is characterized by exponentially increasing risks, determined by the level and capabilities of diagnostics and the level of condition monitoring, which is still low for critical situations. The areas and challenges discussed are characterized by a historically established sequence of development, both scientific and engineering methods of calculation and testing, the creation of design and manufacturing standards and regulations, and ensuring their operation under design conditions and parameters. In addition to general approaches, the report examines the practical applications of systems at hazardous industrial facilities.