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PECULIARITIES OF APPLYING THE APPLIED MECHANICS CONCEPT IN MODERN MANUFACTURING

To ensure technological progress and increase the competitiveness of modern enterprises, it is advisable to apply the principles of applied mechanics and engineering design. This is a complex field that encompasses methods and tools, the constant application of which ensures the achievement of maximum efficiency in the development, manufacturing, and operation of machines, mechanisms, and equipment.

Applied mechanics is a science that combines physics, mathematics, and engineering to understand how real-world mechanisms work and learn how to create strong, reliable, and efficient parts and machines. It studies the laws of motion and interaction of mechanical systems and applies them to create real technical solutions.

The concept of applied mechanics is based on the application of physical and mathematical laws to solve real engineering problems, minimize material and energy losses, and form a culture of innovation and technical excellence. The main emphasis is on the design, modeling, and analysis of machines, mechanisms, and structures. The main goal of the specialty is to create reliable, effective, and safe technical solutions that meet modern standards.

In the context of a dynamic market environment, and the requirements of Industry 4.0, the ability to quickly design, analyze, and implement effective mechanical systems determines the level of an enterprise's competitiveness. Traditional manufacturing approaches are often accompanied by non-optimal structural solutions, high material consumption, and low reliability. In contrast, applied mechanics emphasizes creating functional value for the client, optimizing designs, and increasing productivity and reliability through the systemic analysis of stress-strain state and process standardization.

The specialty "Applied Mechanics" trains engineers who are able to combine fundamental knowledge with practical skills to create modern technical solutions. The specialty covers key engineering disciplines: Theoretical Mechanics, Strength of Materials, Machine Parts, Mechanical Engineering Technology, CAD/CAM/CAE Systems (Computer-Aided Design, Manufacturing, and Engineering Analysis). This enables specialists to develop new mechanical systems, improve existing ones, and optimize them systematically.

Implementing the principles of applied mechanics allows for the optimization of production and organizational processes, simplifying communication between departments and increasing the speed of engineering decision-making. This is possible through the use of modern tools: 3D Modeling, Numerical Methods, Computer Engineering, Load Simulations.

For instance, the use of Finite Element Analysis (FEA) allows for a significant increase in the quality and reliability of design, while reducing the stages of full-scale testing and development time. The principles of materials mechanics contribute to the

rational selection of materials and the reduction of their overuse, and the application of 3D printing technologies accelerates the creation of prototypes. Applied mechanics allows you to model loads, predict the behavior of structures, and develop modern engineering solutions – from cars and robots to industrial equipment.

In production and management processes, technological waste is eliminated – specifically excessive inventory of parts, unjustified tolerances, material overruns, equipment downtime, and unnecessary movements. The application of tools such as Multi-body Dynamics modeling and Topology Optimization ensures systemic process control, minimizes losses, and allows for the avoidance of resource, time, and effort overruns.

The specialty "Applied Mechanics" is widely used in: Mechanical Engineering, Aviation, Automotive Industries, Energy, Robotics. Graduates can work as design engineers, technologists, designers, and specialists in technical analysis and modeling. It opens up wide opportunities for work in various industries that require accurate calculations, innovative approaches, and the ability to work with advanced technologies. The success of applying Applied Mechanics principles largely depends on the competence of the engineering personnel and support from the management of the enterprise.

Applied mechanics allows an enterprise to adapt to technological changes, improve product quality, reduce the time for launching new products, and strengthen competitiveness in the modern market. Additionally, applying these principles contributes to increasing consumer loyalty due to stable product quality, equipment reliability, and faster reaction to their technical needs. In the long term, the Applied Mechanics approach forms a sustainable engineering culture oriented towards efficiency, innovation, and technical excellence. By mastering applied mechanics, a future specialist acquires the ability to influence the development of technology, increase production efficiency.

Therefore, the implementation of Applied Mechanics principles not only optimizes structural and technological processes but also creates a foundation for transforming the enterprise into a modern, flexible, and competitive engineering organization.

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