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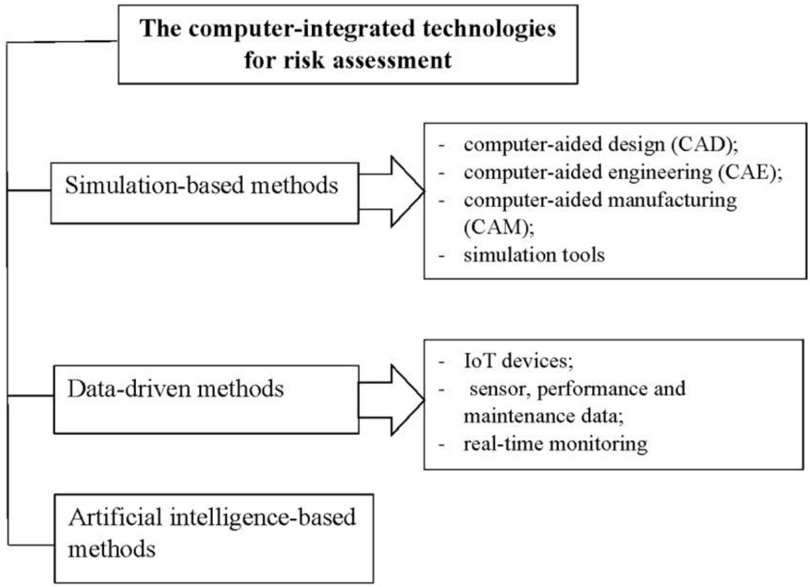
PROSPECTS FOR THE USE OF RISK ASSESSMENT METHODS IN PLANNING THE LIFE CYCLE OF ENGINEERING PRODUCTS

The development of engineering products involves various risks that need to be identified and managed to minimize the potential negative impacts on the product's life cycle. Risk assessment is a critical component of the product development process, enabling the identification and management of potential risks that could impact the product's life cycle. With the advancements in computer-integrated technologies, new opportunities have emerged for conducting risk assessments more effectively. This paper examines the prospects of using risk assessment methods in planning the life cycle of engineering products.

In the context of engineering products, risk assessment is a critical component of the product development process, enabling the identification and management of potential risks that could impact the product's life cycle. The life cycle of an engineering product includes various stages, such as design, development, testing, production, operation, maintenance, and disposal [1]. Each stage of the life cycle presents unique risks that need to be identified and addressed to ensure the product's safe and reliable operation.

Effective risk assessment enables product developers to identify and mitigate potential risks before they cause harm or damage [2]. It enables product developers to make informed decisions about product design, testing, and maintenance, ensuring the product's safety, reliability, and performance. Risk assessment also enables product developers to comply with regulatory requirements and industry standards, ensuring that the product meets the necessary quality and safety standards.

Computer-integrated technologies have significantly impacted the field of risk assessment by enabling the use of advanced methods and tools for conducting risk assessments [3]. The use of computer-integrated technologies in risk assessment can provide various benefits, such as improved accuracy, efficiency, and transparency. Some of the computer-integrated technologies that can be used in risk assessment are shown in Picture 1.



Pic. 1. The computer-integrated technologies for risk assessment

Simulation-based methods involve the use of computer simulations to model and analyze the potential risks associated with the product's life cycle. Simulation-based methods can provide a more accurate assessment of the risks and enable the evaluation of different scenarios [5].

Data-driven methods involve the use of data analytics to identify and manage potential risks associated with the product's life cycle. Data-driven methods can enable the identification of trends and patterns that could impact the product's life cycle.

Artificial intelligence-based methods involve the use of artificial intelligence algorithms to analyze and manage potential risks associated with the product's life cycle. Artificial intelligence-based methods can provide a more efficient and effective approach to risk assessment.

Computer-integrated technologies also enable the development of predictive maintenance strategies enables product developers to identify potential risks and take proactive actions to prevent failures or malfunctions. Predictive maintenance strategies involve the use of various data sources, such as sensor data, performance data, and maintenance data, to predict potential failures or malfunctions and take preventive actions.

Risk assessment is a critical component of Industry 4.0 as it enables manufacturers to comply with regulatory requirements and industry standards, ensuring that the product meets the necessary quality and safety standards [5–7].

Industry 4.0 also enables the use of advanced methods and tools for conducting risk assessments. These methods and tools include:

1. **Predictive Maintenance**: Predictive maintenance is a strategy that involves the use of various data sources, such as sensor data, performance data, and maintenance data, to predict potential failures or malfunctions and take preventive actions. This strategy enables product developers to identify potential risks and take proactive actions to prevent failures or malfunctions.

2. **Digital Twin**: A digital twin is a virtual replica of a physical product or system that enables the simulation and modeling of the product's behavior in various operating conditions. This enables product developers to optimize the product design and identify potential risks that could impact the product's performance and safety.

3. **Risk Analysis Software**: Risk analysis software is a tool that enables the identification, analysis, and evaluation of potential risks associated with a product or system. This software enables product developers to identify potential risks and take corrective actions to mitigate the impact of these risks.

Thus the prospects for using risk assessment methods in planning the life cycle of engineering products are significant. The use of computer-integrated technologies in risk assessment can provide various benefits, such as improved accuracy, efficiency, and transparency. Additionally, the use of risk assessment methods can enable the identification of potential risks early in the product development process, which can help reduce the potential negative impacts on the product's life cycle.

The existing risk assessment methods and tools can be evaluated for their suitability for use in planning the life cycle of engineering products. For example, simulation-based methods can be used to model and analyze the potential risks associated with the product's life cycle. Data-driven methods can be used to identify and manage potential risks, while artificial intelligence-based methods can be used to analyze and manage potential risks more efficiently.

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