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Introduction of Digital Doubles

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Abstract: *This article provides some information about digital doubles.*

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One of the methods of using information technology in industry is the use of digital twins, with the help of which it is possible to connect physical objects of the production environment with digital systems, which can significantly improve the way of developing and testing new products, According to a study by the consulting company Deloitte, the digital twins market will reach $ 35 billion by 2025, since many industrial sectors, including aerospace, defense, as well as transport and automotive, they are interested in the possibilities of digital doubles and invest in this technology. According to information from a study conducted by Gartner, by 2031, the total market for digital twins will reach a value of $ 183 billion.

A digital twin is a dynamic and virtual model of a part, object, equipment or an entire production process, which consists of a physical object, a virtual representation of this object, as well as their connection, through which it is possible to transfer data between a physical and virtual object. There are three different types of doubles, each of which performs certain tasks.

Digital counterparts are prototypes. This digital twin is a virtual model for a real physical object and includes both data for a comprehensive description of the model and requirements for production conditions.Digital doubles are instances. This type of digital twin is used to store data on the description of a physical object and usually contains an annotated three-dimensional model, as well as data on materials and components, processes performed, data received from sensors.Aggregated digital double. This digital doppelganger is a computing system that is used to combine all digital doppelgangers, as well as their real prototypes, in order to collect data and transmit it.

Thus, due to the dynamic functionality of the digital double, it does not perform the role of a digital drawing, but includes all the elements of the object and how this object functions in the real world. With the help of data obtained in real time in the physical world, it is possible to perform simulation using a virtual environment.

To perform 3D modeling and visualization of physical objects, digital doubles can use both virtual and augmented reality tools. The necessary data is obtained using industrial Internet of Things devices, as well as various sensors. Thus, it is possible to ensure that the digital double accurately displays an object or process in an industrial enterprise at a given time.

Thanks to these functions, the digital twin can be used for critical production components or the entire equipment. With the wider use of this technology, it is possible to create models for tracking individual production operations or the entire technological line of an industrial enterprise.

Digital twins are used in many industries, especially those where the development of complex technological products and products is carried out, errors in the design of which can cost the company significant financial losses, for example, due to the need to withdraw this product from the market.

An example of one of these industries is the automotive industry. Engineers working in this industrial sector need to create a virtual environment, through which it is possible to perform testing, consider various parameters and characteristics of both the car itself and its components, including such complex elements as an internal combustion engine. The development of a new engine model is a key task for another industry – aviation. When developing it, it is necessary to correctly determine the design of the engine and calculate its performance characteristics. In this case, the technology of digital doubles allows you to test its capabilities under various weather conditions by creating a digital model of the engine. The use of simulation using digital twins in the development of new types of engines makes it possible to simplify this time-consuming process and increase the efficiency of engineers employed in this industry.

In the oil and gas industry, digital twins are also being introduced at various industrial enterprises. With their help, it is possible to increase the productivity of drilling rigs through predictive analysis. Performing testing using physical data in real time in environments that simulate typical as well as extreme operating conditions of an oil or gas installation allows engineers to obtain the necessary calculations that are used to optimize the operation and improve the performance of oil and gas installations.

Conclusion: One of the most common examples of the use of digital twins in the energy industry is the testing of wind turbines. With the help of data obtained from sensors installed on a physical turbine, in real time, it is possible to create a virtual turbine model that will be used to study various conditions and their impact on turbine performance, thanks to this it becomes much easier to make an accurate forecast to calculate turbine performance over a certain period of time and the amount of energy that which can be obtained with its help.

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