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Training Students to Monitor Product Quality in CAD for Car Industry

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Abstract
Training of skilled specialists capable of designing qualitative products within the car industry could be hardly secured without the introduction of modern automated design systems into education programmes. Within the degree programme in "Mechanical Engineering", 15.03.01 offered by Togliatti State University Siemens PLM Software NX is applied. The proposed programme is comprehensive and aimed at product quality enhancement at the stage of product design. A great attention is also paid to evaluating the quality of the products subject to pressure shaping via CAE program Autoform, Deform and LS-DYNA.

Key words: bachelor's degree programme, curriculum, car industry, automated design, model design, product quality, metal pressure shaping, comprehensive education, product lifecycle management, CAD.

A modern car should be functional and meet high quality requirements. These characteristics should be considered at the stage of car design and manufacture. The experience of modern car manufactures indicates that the product quality is defined not only by its configuration, but also by the system of arrangements that constitute a part of nominative documents, standards and various programs of international communities and enterprises related to the car industry.

PLM (Product Lifecycle Management) is currently a fundamental software tool to support the development of highly-competitive products. It helps manage data at the stage of car design and manufacture. Precisely, it includes CAD, ERP, and SCADA. To operate these systems, there is a need for the specialists who possess knowledge of the up-to-date engineering technologies and have gained working experience in IT and PLM software. They are able to provide professional support to car manufacturers.

Togliatti State University offers the bachelor's degree programme in "Mechanical Engineering", 15.03.01 and master's degree programme in "CAD in Mechanical Engineering", 15.04.01 aimed at training specialists capable of fulfilling a wide range of activities related to modern car design, use of up-to-date technologies and the integrated PLM software.

Special knowledge of mechanical engineering fundamentals and CAD basis obtained by bachelor students is consolidated within the master's degree programme. Alongside enhancement of professional skills in certain fields of mechanical engineering, future master students also get familiarized with the disciplines related to PLM software and gain relative working experience.

The curricula of cross-engineering and special engineering courses are designed so that bachelor students are explained how to use CAD system in the mechanical industry. For this purpose, computer-aided design and management tools have been introduced


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into the courses of professional training both for students and faculty members.

Quality product courses are of particular importance in the discussed education programmes. The issues related to product quality management (CAD system and SCADA) are considered.

Quality criteria for geometric layouts intended for electrical models of products are listed in Russian All-Union State Standards (GOST) [1, 2]. They are based on the international standard ISO/PAS 26183:2006 [3]. In NX software, the model quality requirements are developed via VDA and SASIG (ISO/PAS 26183) [4, 5].

When designing and developing new models in CAD systems, students are trained to use various tools of inspecting the geometry of car detail models and searching for errors in certain product models. For example, technology of visual presentation HD3D supplemented by NX Check-Mate tools is applied in Siemens PLM Software NX. It ensures direct visual interaction, thus, facilitating error search and defect elimination (fig. 1, fig. 2).

The inspection reports are also developed in NX software. They include the certain values, dimensions, structure and local geometry defects based on the enormous number of features. A user can independently initiates inspection and select the programs suitable for error detection, description and visualization. Fig. 2 illustrates the defect search menu based on the minimum bend radius criterion.

Master and bachelor students learn the fundamentals of model quality inspection in the following courses: "CAD fundamentals", "Modeling of objects and processes of mechanical engineering in CAD", "CAD of processes and accessory for sheet-metal stamping", "CAD fundamentals in PLM", "Engineering analysis of objects and processes in CAE" and demonstrate the gained knowledge in course papers and final qualification works.

The proposed programmes are comprehensive and aimed at enhancing product quality both at the stage of design and development of technological processes and accessory. A great attention is paid to the quality evaluation of the products subject to pressure shaping via CAE program Autoform, Deform and LS-DYNA. During practice and lab classes, students master the methods to detect such defects as rupture, thinning, springing, scratch, underfilling and other ones that peculiar either for sheet-metal stamping or bulk forming. Numerical

Fig. 1. Results of detail geometry inspection in HD3D NX.

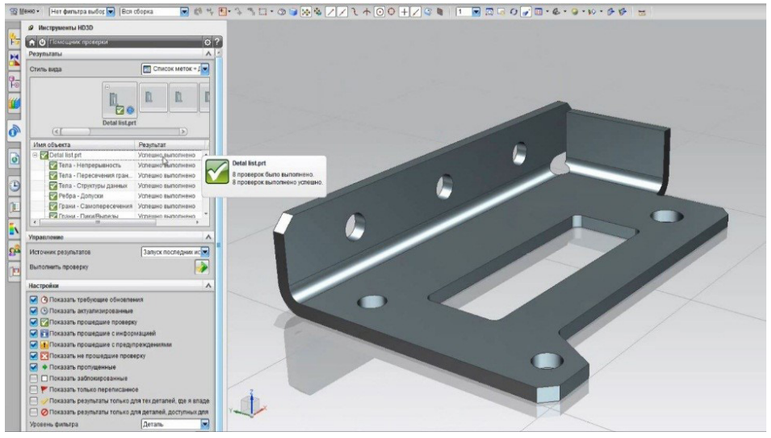
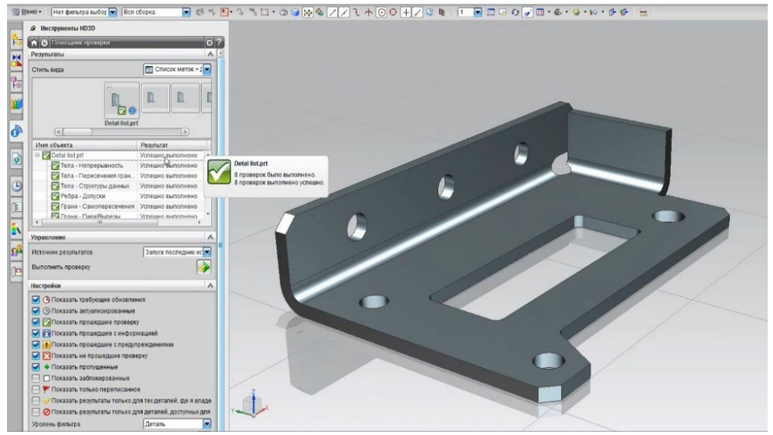


Fig. 2. Visual report menu of detail workability inspection in NX software



experiments help students understand the principles of detecting and eliminating the possible reasons for manufacturing defects and enhance the product quality in the car industry.

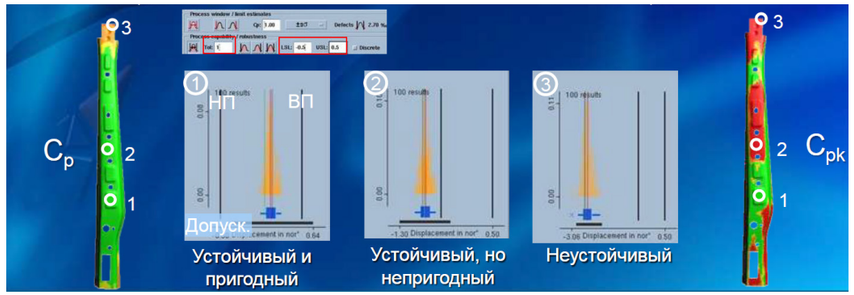
Statistical analysis is also of great importance in the study of sheet-metal stamping processes and their workability. A number of master's dissertations are devoted to modeling various technological processes, precisely sheet-metal stamping in accordance with GOST R 50779.44-2001 [5]. Determination of reproducibility indexes and usability of technological processes allow making the conclusion on stability and availability of technological process management [6]. The forecast of product quality including the above-mentioned parameters is carried out via a great number of tools which detect the product defects at different manufacturing stages (fig. 3).

Further enhancement of training students capable of using the methods of quality improvement via CAD in the car industry is associated with the introduction of CAM quality control.

Conclusion

To shape the required graduates' competence in automated object and process design that ensure manufacture of highly-qualitative products could be achieved only by means of comprehensive education programmes which embrace CAD fundamentals both at the stage of model design and development of technological processes and accessory.

Fig. 3. Stamping reproducibility indexes in Autoform



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Modernization of Personnel Training for Economic Development

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Abstract
This article considers the need to modernize the national system of training personnel with a university degree to ensure the growth of industrial output and the significant increase in the production of innovative products. The task of universities is to improve pedagogical skills of teachers so that they could efficiently use modern teaching technologies. Universities must generate students' fundamental competence, which is the commitment to quality. It is proposed to discuss new principal approaches to the system of education and upbringing. The article expresses the view that relatively soon the training of graduates with a Bachelor's degree in technical fields may hamper the development of modern innovative economy.

Key words: quality, economy, education, bachelors, engineers, competence, time challenges.

It is generally accepted that the modern world is the world of quality, and we constantly witness it. In life, we want and sometimes demand to receive products or services of the highest quality. And what about the "return"? How do we behave when we produce our own products or provide services to anyone? And how do we get along with our neighbours? What do we teach our children? How do we drive a car? How do we repair roads? How do we teach and provide medical care for people?

For all advanced countries, the quality of products, which is currently determined not only by physical, but also intellectual capital, has become the driving force of development.

It may be said that knowledge economy is becoming one of the main challenges of the XXI century.

This takes place at a time when the world economy is already experiencing the trends of the third industrial revolution. It will result in the decrease in workers engaged in material production and the majority of them will be involved in intellectual work, such as development, research and design.

It means that economy needs employees of the new formation, able to meet time challenges. This is the task of education system. In the twenty-first century, it must not simply provide knowledge to students, but also guarantee their creative development.

The mutual relationship between education and economy is presented in Fig. 1.

This diagram clearly demonstrates that education is the foundation of social development. In his work "Russia: Virtual and Real Political Prospects", M. Urnov, the National Research University Higher School of Economics, notes that the shortage of qualified personnel is the key factor that hinders the economic growth and modernization of Russia.

In 2003, the Russian Federation became a full member of the European educational

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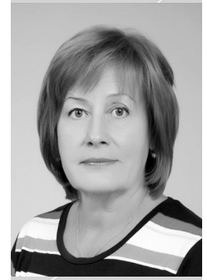

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