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STEAM-TURBINE, GAS-TURBINE, AND COMBINED-CYCLE PLANTS AND THEIR AUXILIARY EQUIPMENT

Modern Technologies for Rendering Information Support to Cogeneration Steam Turbine Units in Their Design and Operation Stages

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Abstract—Application of modern information technologies in different stages of the lifecycle of cogeneration turbines is considered as one of possible ways for improving their competitiveness. Specific features relating to rendering information support for steam turbine units during the periods of their design and operation, which are the main stages of their life cycle, are presented. Three-dimension modeling, adaptive, and parametric design technologies are applied in the equipment design stages. Information support technologies developed by the authors are applied during the operation stage. Information is integrated by using a product lifecycle management (PLM) system.

Keywords: turbine, steam-turbine unit, designing, operation, information support, modeling, lifecycle

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Increased differentiation of the social and economic situation in regions has become one of the consequences resulting from the changes that occurred in Russia in the 1990s. In this connection, we are witnessing increased migration mobility of population. A growth of population and, as a consequence, more intense construction of residential houses is observed in regions where the economic potential has concentrated.

The climatic conditions in Russia are a factor due to which special requirements are imposed on a method used to generate heat. As is well known [1], combined generation of electricity and heat at thermal power stations (TPSs) offers, along with fuel saving, essential social and environmental advantages of such energy generation method. Despite the fact that many alternative energy- and resource-saving heat supply technologies have emerged (such as heat pumps and thermal energy storages), the use of which makes it possible to exclude the use of expensive heat networks, which are also characterized by labor-consuming repair, combined generation of heat and electricity still remains an important choice when the problem of supplying heat to entire urban areas, especially large cities is to be dealt with. Therefore, the need to construct new and retrofit existing cogeneration steam turbine units (STUs) is beyond question.

Competition among turbine works has become essentially more intense as world-level manufacturers of steam turbine equipment emerged. Extensive use of modern information technologies in all stages of the STU lifecycle is one of possible ways for improving the competitiveness of the manufactured equipment and manufacturing process as a whole.

In automating any lifecycle stage of cogeneration STUs, e.g., the stage of working out their design, a partial information model has to be developed for the subject area under consideration as a totality of concepts (entities), values of their attributes (properties), and correlations. In constructing a model, concepts reflecting the subject area entities are formed first, after which a set of attributes belonging to these concepts is generated, and finally, correlations between the concepts are established that correspond to relations between the subject area entities. The information model of the STU construction design process serves for exchanging information about equipment. That is, on one hand, this model is a source of information for all application systems used at the given stage (including drawing, computation, text, document handling ones, etc.), and on the other hand, it unites all results from the operation of these systems. The main difficulty is that an extremely large set of methods, languages, and models for representing information about a steam turbine unit is used in practical applications.

The progress achieved in development of web technologies opens the possibility to create so-called "virtual enterprises" uniting specialists working at different institutions situated in different territories and spatially separated from each other at distances of several hundred and even thousand kilometers. By using the technology of continuous acquisition and life cycle support (CALS) for a product, it becomes possible to