

Improving the Technology of Assembly by Use of Computer Calculations

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Abstract : Assembling accuracy is the degree of accordance between the actual values of the parameters obtained during assembly, and the values specified in the assembly drawings and technical specifications. However, the assembling accuracy depends not only on the quality of the production process but also on the correctness of the assembly process. Therefore, preliminary calculations of assembly stages are carried out to verify the correspondence of real geometric parameters to their acceptable values. In the aviation industry, most calculations involve interacting dimensional chains. This greatly complicates the task. Solving such problems requires a special approach. The purpose of this article is to carry out the problem of improving the technology of assembly of aviation units by use of computer calculations. One of the actual examples of the assembly unit, in which there is an interacting dimensional chain, is the turbine wheel of gas turbine engine. Dimensional chain of turbine wheel is formed by geometric parameters of disk and set of blades. The interaction of the dimensional chain consists in the formation of two chains. The first chain is formed by the dimensions that determine the location of the grooves for the installation of the blades, and the dimensions of the blade roots. The second dimensional chain is formed by the dimensions of the airfoil shroud platform. The interaction of the dimensional chain of the turbine wheel is the interdependence of the first and second chains by means of power circuits formed by a plurality of middle parts of the turbine blades. The timeliness of the calculation of the dimensional chain of the turbine wheel is the need to improve the technology of assembly of this unit. The task at hand contains geometric and mathematical components; therefore, its solution can be implemented following the algorithm: 1) research and analysis of production errors by geometric parameters; 2) development of a parametric model in the CAD system; 3) creation of set of CAD-models of details taking into account actual or generalized distributions of errors of geometrical parameters; 4) calculation model in the CAE-system, loading of various combinations of models of parts; 5) the accumulation of statistics and analysis. The main task is to pre-simulate the assembly process by calculating the interacting dimensional chains. The article describes the approach to the solution from the point of view of mathematical statistics, implemented in the software package Matlab. Within the framework of the study, there are data on the measurement of the components of the turbine wheel-blades and disks, as a result of which it is expected that the assembly process of the unit will be optimized by solving dimensional chains.

Keywords : accuracy, assembly, interacting dimension chains, turbine

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