OPTIMIZATION OF OPERATING PARAMETERS OF HYDRAULIC MACHINES

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When designing the flow part of a hydraulic machine, much attention is paid to the task of determining the optimum operating parameters, such as reduced flow and reduced speed, at which the efficiency takes the maximum value. To solve this problem, it is possible to use different approaches, which depend on the degree of detail of available data when solving it. When solving this problem, it is possible to use methods of calculation the balance of losses in various modes. Determination of optimum parameters Q'_{Io} and n'_{Io} as well as estimation of maximum hydraulic machine efficiency $\eta_{\max}$ requires a lot of computational work. The solution of the above mentioned problem is simplified if we take the approach when the spatial runner blade system is replaced by an equivalent grid of profiles and its characteristics are replaced by the data in the characteristic cross sections at inlet and outlet of the grid. The geometrical, kinematic characteristics of the average lattice in the characteristic sections are obtained by averaging over the flow rate of the corresponding characteristics of the spatial runner blade system. The characteristics in the inlet elements of the flow part are replaced by the averaged parameters in the characteristic sections behind the stator vane system (spiral + stator grid) and the guide vane (circular grid of the guide vane). This approach makes it possible to determine in first approximation energy losses in all elements of hydraulic machine flow part, guide vane opening, kinematic characteristics of flow in characteristic sections, as well as hydraulic machine throughput capacity. Using this approach to the description of flow part we obtain analytical dependences in the form of algebraic equations, linking hydrodynamic characteristics of elements of flow part of hydraulic machine with regime parameters. Thus, having data in characteristic sections of the hydraulic flow part, it is possible to find mode parameters of the optimum mode corresponding to maximum efficiency, optimum opening of the guide vane, averaged flow twist before and after the runner. Such approach allows to investigate the influence of geometry of flow part on parameters of optimum mode at the stage of designing to provide required parameters Q'_{Io}, n'_{Io} and to optimize elements of flow part.