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Improving the efficiency of the operating process of high specific speed torque-flow pumps by upgrading the flowing part design

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Introduction

The study is devoted to the research of the torque-flow pump (Fig. 1) operating process. Its work is closely connected to the formation and stable functioning of the toroidal vortex. The theoretical bases of the formation of a toroidal vortex and the process of energy transfer in a torque-flow pump are considered in the research (vane and vortex components of the operating process, Fig. 2). The fact of the **presence of some additional hydraulic losses** due to the **mismatch of the location of the toroidal vortex center and the impeller blade edges** has been established. The urgency of the paper is **increasing the efficiency of torque-flow pump** by improving its flowing part.

The purpose and objectives of the research

The purpose of the research is to **improve the efficiency of a torque-flow pump** with high specific speed ns by improving the design of its flowing part.

To achieve this goal, the **main tasks** are defined:

- theoretical substantiation of the possibility of efficiency increasing of the operating process of a torque-flow pump flowing part with high specific speed;
- identification of the main ways of increasing the efficiency of torque-flow pumps;
- researching of the influence of the torque-flow pump advanced design on its characteristics by performing a numerical investigation.

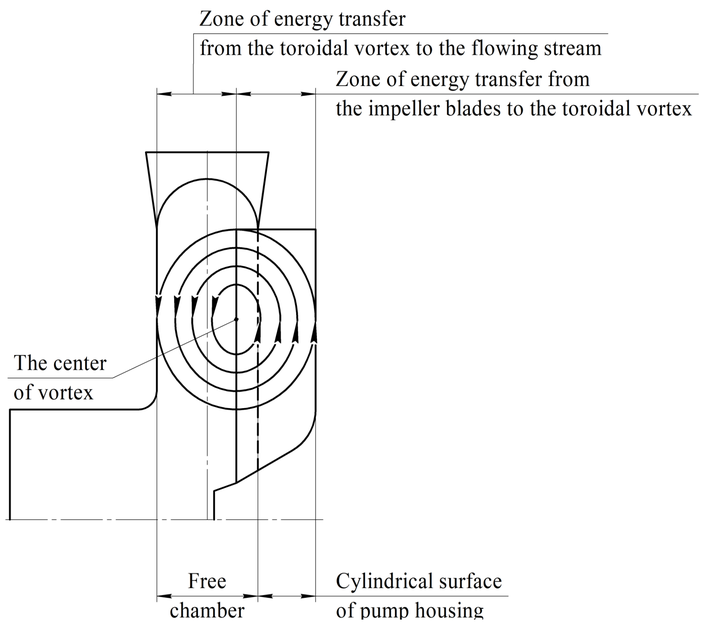

Figure 2. Features of the toroidal vortex structure of a torque-flow pump with high specific speed ns of the advanced flowing part design

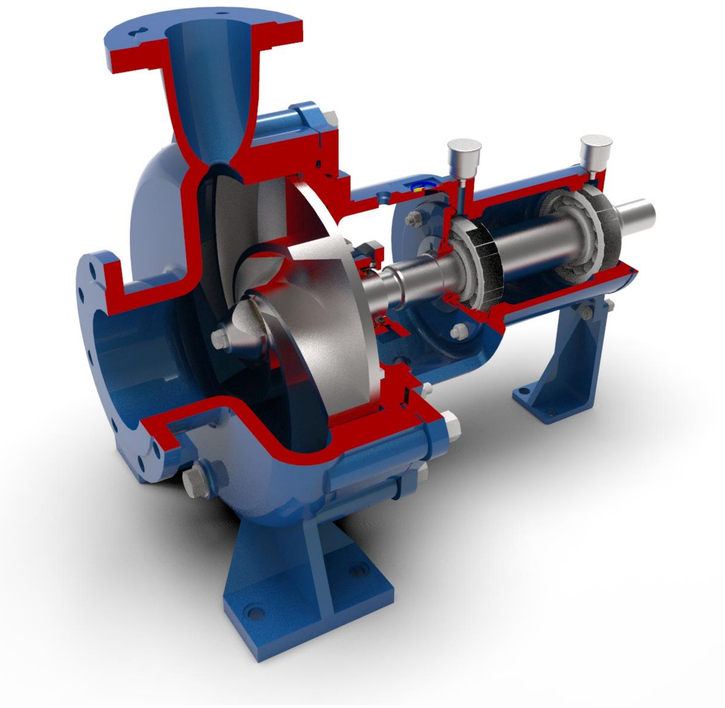

Figure 1. Torque-flow pump SVN-type

Results

According to the results of the research, the characteristics (Fig. 3) of the tested torque-flow pump of active (red) and advanced (blue) design were constructed.

The design improvement made it possible to **increase the efficiency** of the torque-flow vortex pump in the optimal mode **by 8-9%**. **The head** pressure was **increased by 3.2 m**. The position of the best efficiency point (BEP) was moved to 80-85% (400-425 m3/h) from the calculated position.

The achieved results can be explained as follows.

Firstly, in accordance with the theoretical data presented in the paper, the deformation of the toroidal vortex is reduced. The result is an increase of the efficiency of energy transfer in the vortex operating process.

Secondly, the insignificant exit of the impeller blade edge into the pump free chamber slightly increases the blade fraction and reduces the vortex fraction in the general vortex pump operating process (Fig. 10). It allows us to achieve some increase in head and efficiency of the pump.

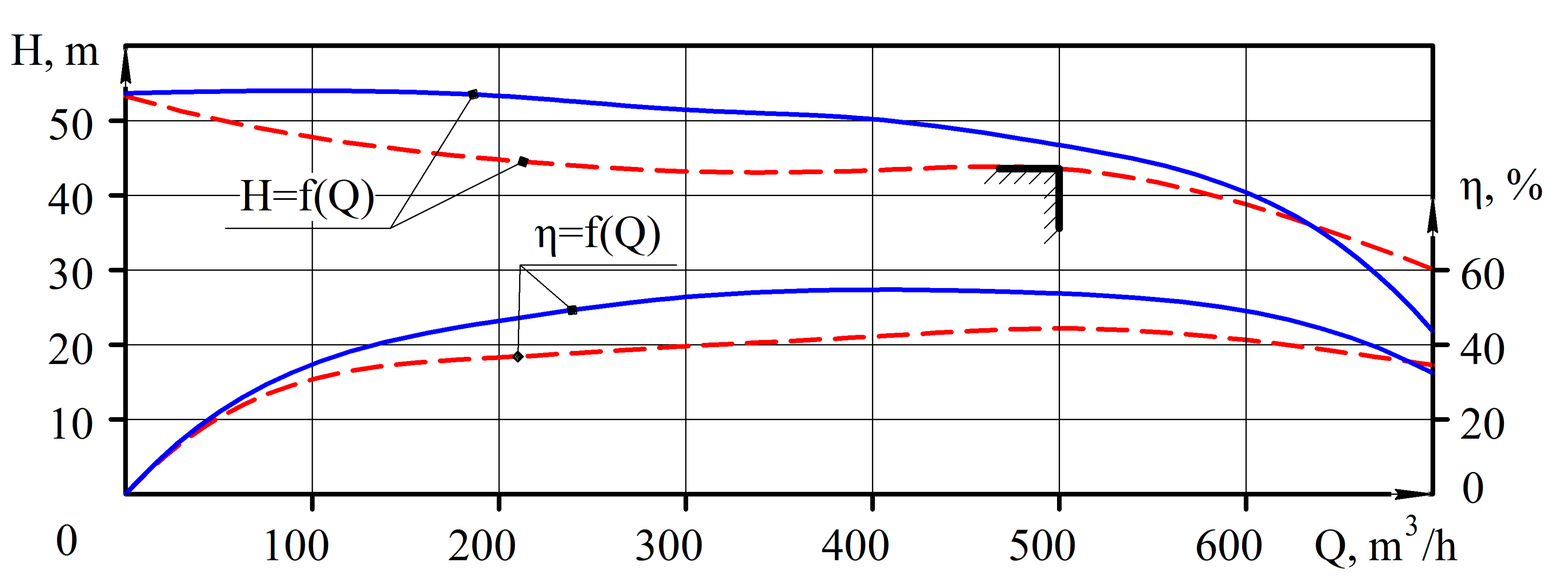

Figure 3. Characteristics of the torque-flow pump of active (solid line) and advanced (dashed line) design

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