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INVESTIGATION OF HYDRODYNAMIC PROCESSES IN GEOTHERMAL PLANT

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ABSTRACT

During the experimental studies physical properties of underground water and gases mixture were analysed and a correlation between pressure and gas content in liquid was determined. Correlation between pressure, temperature and other parameters (density, fluid bulk modulus, sound velocity, kinematic viscosity and relative emission) were determined with respect to the results of the experiments. It was determined that the amount of released gas directly correlates with increased liquid-gas mixture compressibility and slowed down hydrodynamic processes, which changes working properties of centrifugal pump – reduces the natural frequency of the system “subsurface centrifugal pump – pipe line/system”.

Paper analyses an existing geothermal energy extraction system, which consists of a long pipe system and a large number of hydraulic and mechanical elements. Therefore, as the first step of the analysis, were decided to compile a mathematical model of the geothermal system, using the method of concentrated parameters. Mathematical models of asynchronous motor, multilevel depth centrifugal pump mechanical system, depth centrifugal pump (16 levels), absorption pump, piping system and other elements of geothermal energy extraction system were made. Also a universal mathematical model of depth centrifugal pump was made. This model could be used to describe hydrodynamic processes of injection pumps in the pipe systems, where large amounts of released gases influences the productivity of the pump and geothermal energy extraction system overall.

Mathematical model of geothermal system “depth centrifugal pump – pipe (pipe system)” was made, which assesses characteristics of extraction depth centrifugal pump and their correlation with impeller frequency, discharge and other system parameters. Based on this mathematical model the instability zones of the system were determined. Mathematical model of hydrodynamic processes of geothermal system (pumps, piping, heat exchangers and filters) was made. A numerical analysis of hydrodynamic equations of geothermal system was made.