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Hydro-vibroacoustic diagnostics of operation of the prosthetic bileaflet heart valve

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The results of experimental studies of sounds and noise of a mechanical beleaflet heart valve are presented in the report. Physical simulation of the heart valve was performed in the laboratory at the Polytecnico di Milano. A special experimental stand was created in the laboratory. The bileaflet mitral valve of Sorin Biomedica (Italy) was located between the model of the atrium and the left ventricle of the heart. Unique heart sensors, pressure fluctuation sensors and miniature accelerometers, which were designed and manufactured at the Institute of Hydromechanics of the National Academy of Sciences of Ukraine [1, 2], were used to study the hydrodynamic noise and sounds of the heart valve operation. A group of piezoceramic accelerometers were mounted on the surface of the experimental bench, which recorded the bench's vibration from the operation of the heart valve. Hydrodynamic noises, vibrations and sounds of the heart model were simultaneously registered in conditions of open and semi-closed valve operation. The sensors were installed in various places in the upper and down flows through the heart valve. The simulation was performed for stationary flow of pure water and glycerol solution through the mitral valve, as well as for pulsating flow. Differences in the hydrodynamic noise, vibration, and sounds of the heart valve operation in open and semi-closed valve conditions have been determined [3]. The hydro-vibroacoustic diagnostic features of the prosthetic bileaflet heart valve are determined and solutions for the creation of diagnostic equipment based on hydro-vibroacoustic measurements are proposed.

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