

HYDRODYNAMIC MODEL OF CAVITATION OSCILLATION FOR MODELLING DYNAMIC PROCESSES WITHIN PUMP SYSTEMS AT HIGH CAVITATION NUMBER

Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and State Space Agency of Ukraine, 15, Leshko-Popel Str., 49005, Dnepr, Ukraine; e-mail: dolmnut@gmail.com

The paper deals with mathematical modelling the low-frequency dynamic processes within liquid rocket engines (LRE). Attention in the work is devoted to developing the mathematical model of the cavitation oscillation for modelling the dynamic processes within the pump systems at the high cavitation number. To attain this objective, the experimental and calculated dependences of the cavities elasticity on the pump parameters at the high cavitation number are corrected including the cavitation number resulting in cavities within the centrifugal-impeller pump. The dependence of the cavities volume on the operating conditions of the pump is determined using the experimental and calculated method of the measurement of the elasticity and the cavities volume within the centrifugal-impeller pumps. The dynamic cavity equation is derived in the differential form. In the calculations of LRE starting, it allows to use the derived analytical dependences for a nonlinear hydrodynamic model and to take into account the fluid compliance (under cavitation-free conditions of the pump operation) within the supply line without changing the structure of the mathematical model of the LRE starting and discontinuous changing the values of the equation coefficients. The research results can be used to take into account the cavitation effects within the pumps for calculating LRE starting.

Keywords: *liquid rocket engine, centrifugal-impeller pump, cavitation, cavitation oscillation, cavitation number, starting, mathematical modelling.*

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