A HYBRID (HYDRO-NUMERICAL) CARDIOVASCULAR MODEL: APPLICATION TO INVESTIGATE *CONTINUOUS-FLOW* PUMP ASSISTANCE EFFECT

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Abstract:

A hybrid (Hydro-numerical) model of blood circulation developed at the Institute of Biocybernetics and Biomedical Engineering (IBIB) of the Polish Academy of Sciences (PAN) -Warsaw, Poland, in co-operation with the Institute of Clinical Physiology (IFC) of the National Council of Research (CNR) - Rome, Italy, is a basic model of this type solutions commonly accepted by the researchers. It is able to simulate all essential hemodynamic functions of the human cardiovascular system including the heart. During last years, resumption of works on constant-flow non pulsatile rotary pumps to be used as heart support devices is observed because of their small dimensions and easier way of implantation. Control modes of rotary pumps are different and evidently influence heart support effects. The main aim of this paper was to investigate different control systems of rotary pumps in a role of the assist devices. To fulfill this task on the hybrid model, a special computer application was worked out. The investigations included: a) loading characteristics *p(q)* of the rotary pump assignment at two values of a control voltage - 18V, 24V; b) physiological and pathological states simulation including parallel atrial-aortic assistance by the rotary pump. The results of the simulations obtained on the model treated as a "virtual patient" are in agreement with the data received in medical conditions.

Keywords: hybrid (Hydro-numerical) model of blood circulation, constant-flow rotary pumps, parallel atrial-aortic assistance