

Global Numerical Models of Circulatory and Respiratory Systems of Human Body Including Their Interaction and Matter Transport

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Software complex of numerical models for simulation most important survival systems of human body including their interaction and external factors influence was developed. Main attention is focused on numerical simulation of the physical processes inside the respiratory and circulatory systems of all human body, such as distribution of discontinuous waves through the vascular system, hydrodynamical flows inside the tissues and organs including their real anatomical structure, global transport of substances by the circulatory and respiratory systems and others.

To solve correspondent multidimensional equations of elliptic, parabolic and hyperbolic types where developed high order accuracy monotonic difference schemes [1]. Then these schemes where adapted to solve the problems in complex domains on unstructured mesh as well as on complex graph's systems.

This software complex lets us to solve wide class problems arising in modern physiology and medicine. First of all these are the problems of response forecasting for different medical influences, external actions and stresses on human body.

Presented the results of simulation some global processes taken place in to a human body, namely blood flow inside the greater (systemic) circulation and lesser (pulmonary) circulation, air flow inside tracheobronchial section including interaction of respiratory and circulatory systems and convection-diffusion matter transport and others [2,3].

References

- [1] Y.A. Kholodov and J.V. Vorobjev, 1996, "About One Method of Numerical Integration of Discontinuous Solutions in Gas Dynamics", J. Mathematical Modeling, Vol. 8, pp. 77.
- [2] A.S. Kholodov, 2001, "Some Dynamical Models of Multi-Dimensional Problems of Respiratory and Circulatory Systems Including Their Interaction and Matter Transport", Computational Models and Medical Progress, Moscow, Nauka, pp. 127-163.
- [3] A.S. Kholodov, A.V. Evdokimov, 2001, "Quasi-Stationary Spatially Distributed Model of Closed Circulatory System", Computational Models and Medical Progress, Moscow, Nauka, pp. 164-193.