CHARACTERIZATION OF BLOOD PLATELETS SOLVING THE INVERSE LIGHT-SCATTERING PROBLEM WITH PRE-COMPUTED INTERPOLATING SET

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Motivation and aim: The scanning flow cytometer [1] allows one to measure light-scattering patterns (LSPs) of individual biological cells, i.e., the intensity of scattered light *versus* the polar scattering angle. The characterization of cells, described by a few parameters, from the measured LSPs requires the solution of inverse light-scattering problem by global optimization. For particles of complex shape, direct fitting is unfeasible due to large time of solution of direct problem. The aim of this research is to develop a method of solution of inverse light-scattering problem with pre-calculated interpolating set, including error estimation.

Methods and algorithms: We used scanning flow cytometer for measurement of LSPs of individual human blood platelets. The geometry of platelets was approximated by oblate spheroid. We used discrete-dipole approximation (DDA) [2] for the solution of direct light-scattering problem for 500.000 spheroids with different parameters corresponding to blood platelets. All calculations were performed at the supercomputing center of Novosibirsk State University [3]. Then we used them as an interpolating set for the global optimization, determining parameters of each measured blood platelets. The Bayesian approach was used to estimate errors of each parameter.

Results: The method was used for characterization of blood platelets. The accuracy of the solution of inverse light scattering problem was quite good, resulting in sub-diffraction precision in the majority of cases. The determined parameters of blood platelets showed good agreement with literature data. The shape of platelets was changed during activation in accordance with well-known effect of platelets shape change.

Conclusion: The solution of inverse light-scattering problem using pre-computed interpolating set gives accurate results. This method was used for characterization of blood platelets and showed good agreement with literature. It is the only feasible approach for particles with complex geometries.

References:

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