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New approaches to data analysis in laser diffractometry of erythrocytes

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Erythrocyte deformability (ED) is a fundamental property of these cells, significantly affecting the blood circulation. ED may decrease in various diseases, in connection with which a variety of methods for estimating and monitoring the ED are used in clinics. One of the conventional methods of analysis of ED in vitro is laser diffractometry of erythrocytes in shear flow (ektacytometry).
In ektacytometer, a flow of highly diluted suspension of erythrocytes in variable shear stress conditions is illuminated with a laser beam to obtain a diffraction pattern. The diffraction pattern provides information about the shapes (shear-induced elongations) of the cells under investigation. This paper is dedicated to developing new approaches to data analysis in laser diffractometry so that it would enable one to measure not only the average value of ED but also the distribution of the erythrocytes in deformability. We discuss the problem of calibration of laser ektacytometer and test the novel data processing algorithms [1, 2]. Experimentally, we examined 12 specially prepared specimens of blood of rats under the action of 4 different shear stresses. Analysis of the data shows that in conditions of a limited range of digitizing the diffraction patterns, the measurement errors for the mean deformability, deformability scatter, and the skewness of erythrocytes distribution in deformability by our method are respectively 15%, 20% and 20%.

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References

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