

4.3.9. SIMULATION OF MOVING MICROOBJECTS ON DYNAMIC BACKGROUND AND ITS TRAJECTORIES VISUALIZATION

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Presented investigation is dedicated to the technique, algorithms and software development for tracking images of the moving micro-objects with random dynamic background. The results allow estimating parameters of motion behavior and objects interactions for micro- and nano-technologies development.

The development of special measuring systems and techniques of data processing is necessary for trajectory visualization of moving microobjects on the basis of use of microscopes with high resolution. Application of such technologies is especially effectively in the field of materials science and molecular biology that promotes working out of the newest materials and medical preparations. In these directions visualization and manipulation processes on molecular and cells levels will play defining role [1, 2].

The goal of this investigation consists of developing of a method, algorithms and the software for automatic processing of dynamic images with moving microobjects with the purpose of their characteristics and movement interactions investigation. This work includes two parts:

- the development of image models composed of nonhomogeneous dynamic random background and moving microobjects;
- the development of a filtering, tracking and visualization methodology for trajectories of moving microobjects.

The technique of background fields simulation is based on their representation by multi-dimensional Markovian random sequences. It allows to set their spatial covariance functions (during the fixed moment of time) and time autocorrelation functions (in the fixed point of the image) in a wide range of possibilities. Images of microobjects can have the complicated configuration changing in time. Such objects are simulated by means of casual clusters and their trajectories – by random Markovian processes with limited number of positions.

The general methodology of dynamic images processing is resulted in the authors monograph [3]. Developed approach is adapted for formulated problem conditions and corresponding processing algorithms and software are developed. The processing technology includes next stages: a preliminary intraframe filtration; a background compensation; a threshold filtration; a clusterization; objects current coordinates estimation and trajectories visualization.

On fig. 1a the example of single frame image with moving microobjects and non-homogeneous background is represented. On fig. 1b the processed image after back

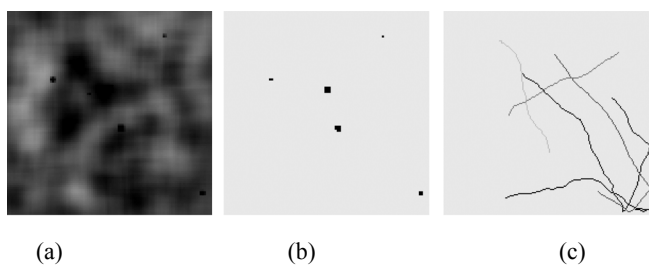


Fig. 1. Microobjects images on a nonhomogeneous dynamic background:

- (a) original; (b) after background compensation and a threshold filtration;
(c) trajectories visualization of allocated microobjects

ground compensation and a threshold filtration is resulted. Fig. 1c demonstrates current trajectories of selected microobjects. These results can be used for estimation of motion behavior and objects interactions parameters.

References:

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2. **Stupp S.I.** ed. Interdisciplinary macromolecular science and engineering / *Proc. NSF Workshop*, 1998.
3. **Artemiev V.M, Naumov A.O., Jaenisch G.-R.** Dynamic images reconstruction in process tomography, Minsk: Belorussian State University publ., 2004.