Frictional-anisotropy-based systems in biology: structural diversity and numerical model

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Supplementary materials

Video 1. Snake_1_1.avi.

This video presents motion of the probe in a system with relatively soft elastic constant K_β. Upper subplot directly illustrates the motion of the probe on the top of dynamically reacting fibers. Another subplot shows time dependence of the instant friction force (blue line) and its average (green line) over elapsed time.

Video 2. Snake_1_2.avi.

The same as in the Video 1 for a motion of the probe in an opposite direction. It can be directly seen how moving hairs turn to an almost vertical position and block the motion of the probe. The result of such behavior is an increase of effective mean friction.

Video 3. Snake_1_3.avi.

Motion of the probe in the system with relatively rigid elastic constant K_β. The subplots are the same as in Video 1.

Video 4. Snake_1_4.avi.

The same as Video 3 for a motion of the probe in the opposite direction.

Video 5. Snake_2_1.avi.

Directed transport in the system with effective elastic constant K_β close to the optimal one. First subplot shows a magnified small part of the system plotted in an accompanying system of the coordinates. The behavior illustrates how moving hairs allow practically free motion of the probe in a right direction and almost block it in a left one. Central subplot gives a general view of the complete system in a static system of the coordinates. Left and right bottom subplots show time dependencies of the probe coordinate X and its velocity V_x, respectively.

Video 6. Snake_2_2.avi.

The same as Video 5 for relatively soft hairs. The system loses its efficiency due to a weak resistance of the hairs to the reverse motion of the probe.