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Anomalous diffusion in a system with a thin membrane

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We consider subdiffusion in a system which consists of two media separated by a thin membrane. The subdiffusion parameters may be different in each of the medium. Using the new method we derive the probabilities (the Green's functions) describing a particle's random walk in the system. From the obtained Green's functions, we derive the boundary conditions at the thin membrane. One of the boundary conditions contains the Riemann-Liouville fractional time derivative, which shows that the additional memory effect is created in the system. The memory effect can be created both by the membrane and by the discontinuity of the medium at the point at which various media are joined. This effect is also created by the membrane for a normal diffusion case.

We also present the generalized method of images which provides the Green's functions for the membrane system. This method, which has a simple physical interpretation, is of a general nature and can be used to find the Green's functions for a system with a thin membrane in which various models of anomalous diffusion can be applied. As an example, we find the Green's functions for the particular case of a slow-subdiffusion process in a system with a thin membrane.

Primary author: Prof. KOSZTOŁOWICZ, Tadeusz (Jan Kochanowski University)

Presenter: Prof. KOSZTOŁOWICZ, Tadeusz (Jan Kochanowski University)

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