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Superdiffusion in a system with a thin membrane

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Superdiffusion is a process in which diffusing molecules can make anomalously long jumps with relatively high probability. This process occurs, among others, in turbulent media and various biological processes related to cell migration. Superdiffusion is often described by the equation with the fractional Riesz derivative with respect to a spatial variable. This derivative is a differential-integral operator with respect to the spatial variable, which makes the equation non-local in space. For this reason, non-local boundary conditions have been used in solving the fractional superdiffusion equation. As far as we know, this equation has not been used to describe superdiffusion in a system thin membranes. A superdiffusion model will be shown, based on an equation with the time-fractional Caputo derivative with respect to another function g (the g -superdiffusion equation). This equation is local in space and can therefore be used to model diffusion processes in a thin-membrane system. By appropriately defining the function g , the g -subdiffusion equation describes superdiffusion in such a way that its solutions (Green's functions) converge to solutions of the fractional superdiffusion equation with a Riesz derivative in the long time limit. Solutions for various boundary conditions assumed at thin membranes will be discussed.

References.

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Primary author: Prof. KOSZTOŁOWICZ, Tadeusz (Institute of Physics, Jan Kochanowski University in Kielce)

Co-author: Dr DUTKIEWICZ, Aldona (Faculty of Mathematics and Computer Sciences, Adam Mickiewicz University, Poznań)

Presenter: Prof. KOSZTOŁOWICZ, Tadeusz (Institute of Physics, Jan Kochanowski University in Kielce)

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