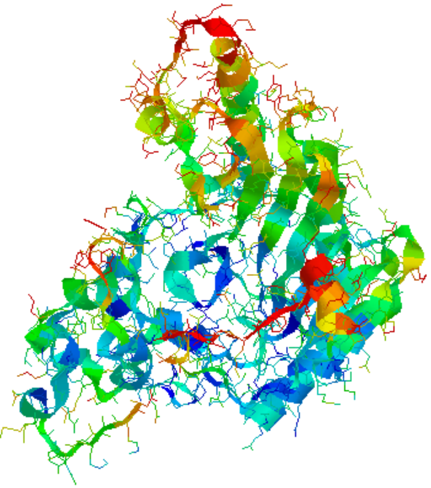
Matematyka w przestrzeni biochemicznej - błądzenie losowe i reakcje

Paweł Nałęcz-Jawecki, Marek Kochańczyk, Jacek Miękisz, Tomasz Lipniacki

Banach Center Conferences
BIOFIZMAT 1

Co, gdzie i jak?



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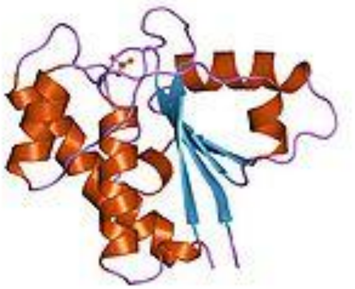
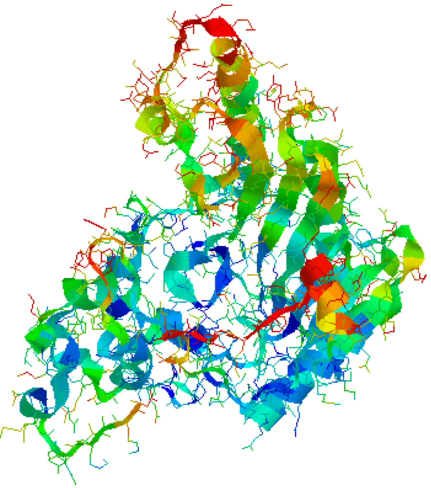


$$\mathrm{K} + \mathrm{S_u} \xrightarrow{c} \mathrm{K} + \mathrm{S_p}$$

$$\mathrm{P} + \mathrm{S_p} \xrightarrow{d} \mathrm{P} + \mathrm{S_u}$$



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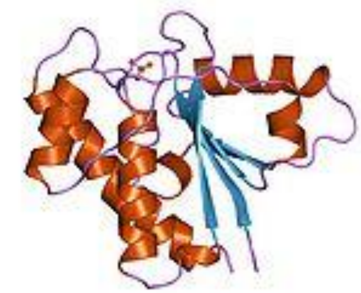

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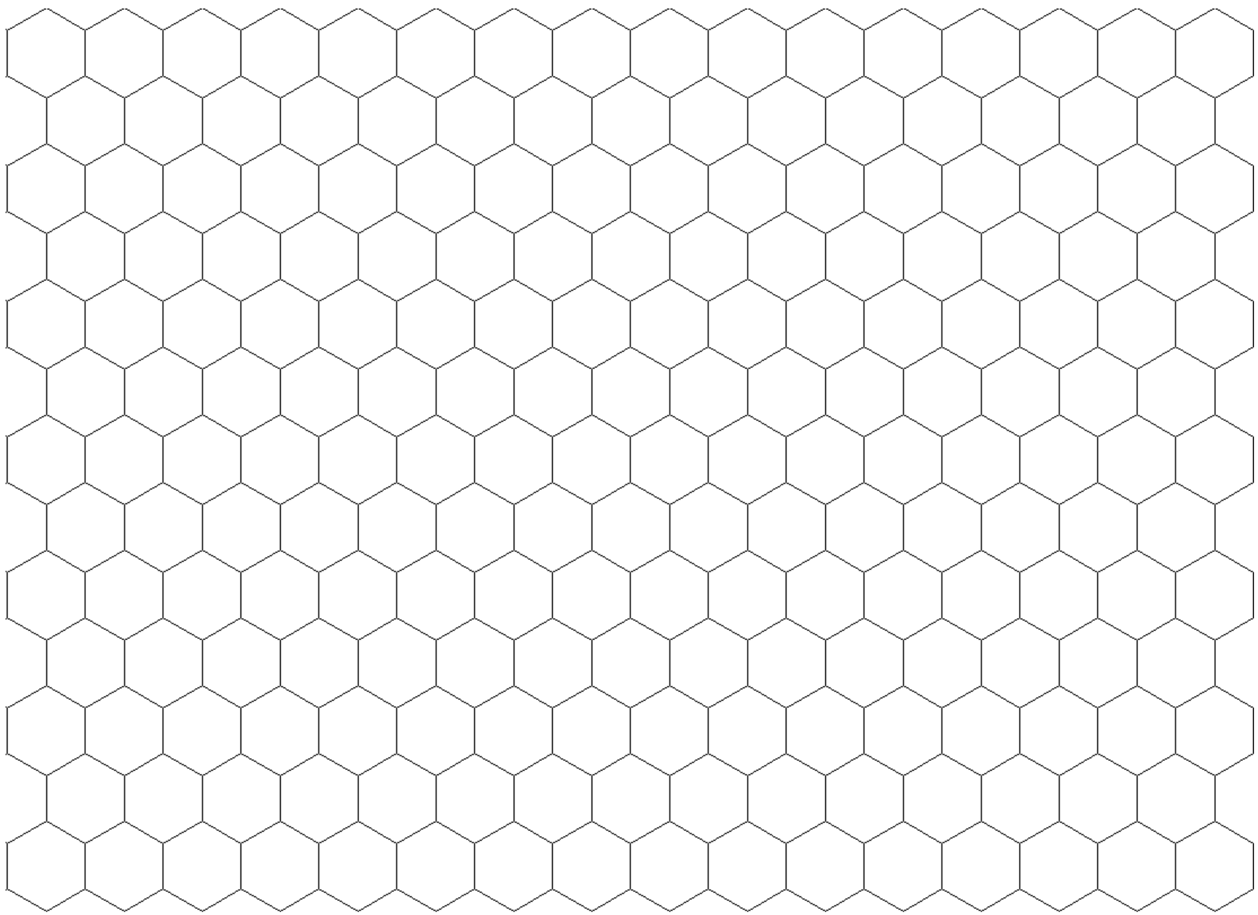
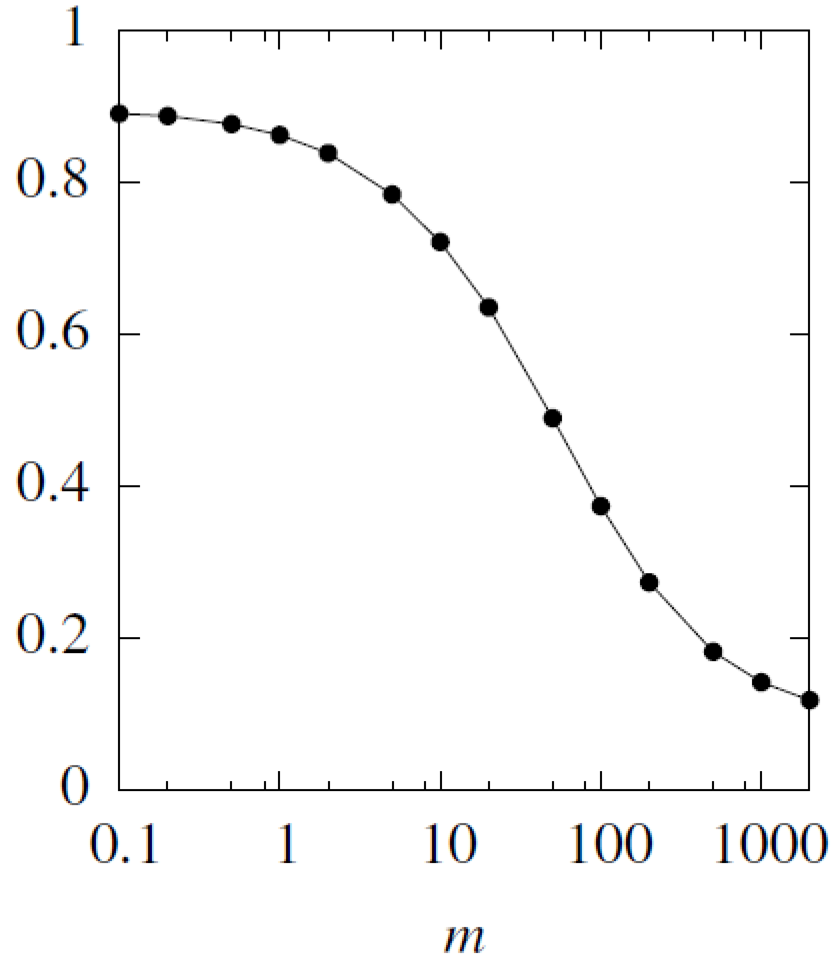


Co chcemy obliczyć?

$$F_{\mathrm{u}} = \frac{\rho_{\mathrm{S_u}}}{\rho_{\mathrm{S}}} \quad F_{\mathrm{p}} = \frac{\rho_{\mathrm{S_p}}}{\rho_{\mathrm{S}}}$$

Zależność frakcji ufosforylowanych substratów od dyfuzji (mało fosfataz, duża intensywność defosforylacji)



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$$R = c_{\mathrm{eff}}\rho_{\mathrm{E}}\rho_{\mathrm{S}}$$

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$$r = \frac{1}{t_{\mathrm{u}} + t_{\mathrm{p}}}$$

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$$c_\mathrm{eff} = \frac{r}{F_\mathrm{u} \cdot \rho_\mathrm{K}}, \qquad d_\mathrm{eff} = \frac{r}{F_\mathrm{p} \cdot \rho_\mathrm{P}},$$

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$$t_{\mathrm{u}_2} = \frac{w(V, n_{\mathrm{K}})}{\tilde{D}_S + \tilde{D}_K}, \qquad t_{\mathrm{p2}} = \frac{w(V, n_{\mathrm{P}})}{\tilde{D}_S + \tilde{D}_p}$$

First Passage Time Problem

$$w(V,1) = \alpha \cdot V \log V + \beta \cdot V + \gamma + O(1/V)$$

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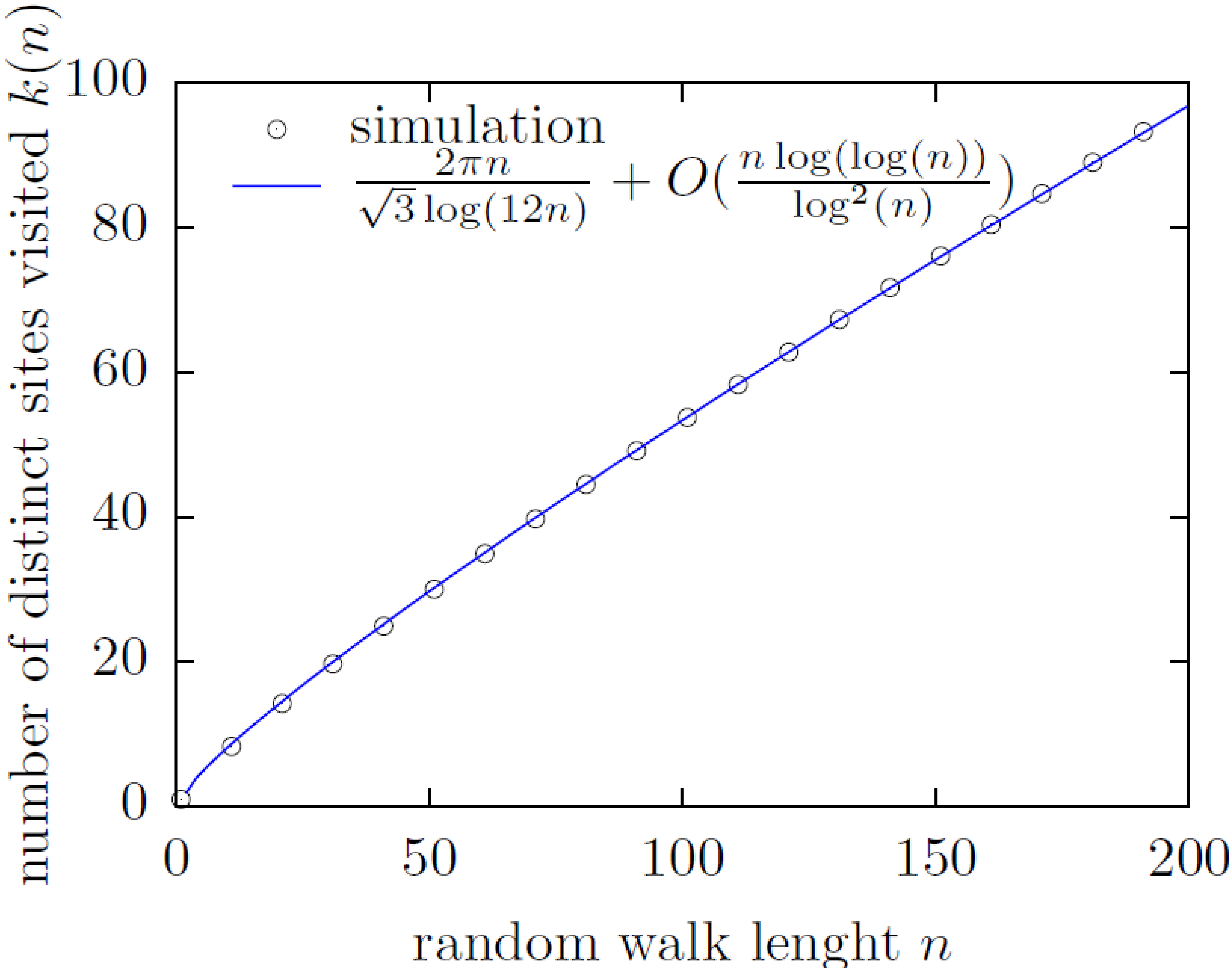
$$c_{\text{eff}} = \frac{1}{\frac{1}{c} + \frac{\rho_{\text{K}} \cdot (\alpha \frac{V}{n_{\text{K}}} \log \frac{V}{n_{\text{K}}} + \beta \frac{V}{n_{\text{K}}})}{\tilde{D}_S + \tilde{D}_K}}$$

Number of sites visited, $k(n)$

Number of sites visited, *k(n)*



$$w(\infty, \rho) = \sum_{n=1}^{\infty} n \cdot p(n)$$

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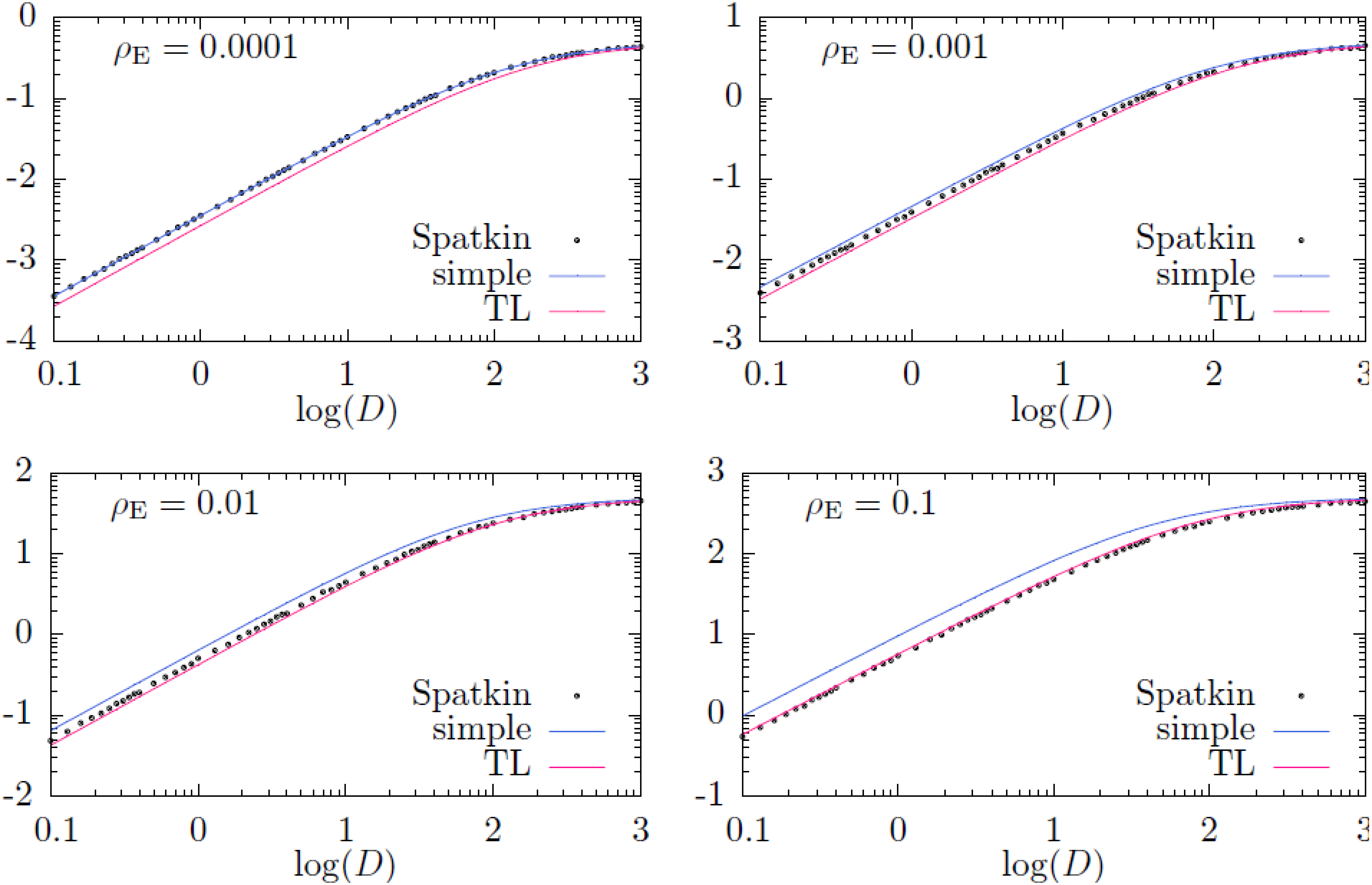
$$w(\infty, \rho) = \rho \frac{2\pi}{\sqrt{3}} \sum_{n=1}^{\infty} (n \left[\frac{n}{\log(12n)} - \frac{n-1}{\log[12(n-1)]} \right] (1-\rho)^{\frac{2\pi(n-1)}{\sqrt{3}\log[12(n-1)]}})$$



$\rho_E = 0.0001$
$\rho_E = 0.001$
$\rho_E = 0.01$
$\rho_E = 0.1$
Spatkin
simple
TL
$\log(D)$

Dziękuję za uwagę