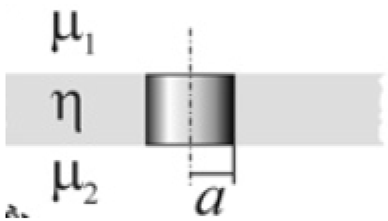
Supplement for the custom MATLAB code for using *Petrov & Schwille's equation* to experimental data

Petrov and Schwille's Equation for the translational diffusion coefficient of a membrane inclusion.

Equation (1) from Petrov and Schwille. *Biophys. J.* 94, 2008.

$$\hat{D}(\varepsilon) = k_B T/(4\pi\eta) \times [\ln(2/\varepsilon) - \gamma + 4\varepsilon/\pi - (\varepsilon^2/2)\ln(2/\varepsilon)] \times [1 - (\varepsilon^3/\pi)\ln(2/\varepsilon) + c_1\varepsilon^{b_1}/(1 + c_2\varepsilon^{b_2})]^{-1}.$$



$$\varepsilon = a(\mu_1 + \mu_2)/\eta$$

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%% Constants
k = 1.38065 * 10^(-23) ; % Boltzmann constant [=] J/K
T = 293 ; % Temperature [=] K (= 20 degC)
eta_fluid = 0.001 ; % Water viscosity [=] Pa.s
gamma = 0.577215 ; % Euler constant

%% Petrov & Schwille Equation Constants
b1 = 2.74819 ;
b2 = 0.51465 ; % Corrected by the authors. Update. Biophys. J. 103, 2012, pg 375.
c1 = 0.73761 ;
c2 = 0.52119 ;

%% Experimental Data (Figure 1f)
R = [0.75 ; 1; 2; 3; 4] ; % Condensate radius [=] um
D_exp = [0.292; 0.203; 0.108; 0.077; 0.051] ; % Diffusivity [=] um2/s
m = length (R) ;

%% Membrane viscosity candidates
n = 10000 ; % Number of candidates for membrane viscosity. Set reasonably large.
eta_memb = linspace(10^(-11), 10^(-7), n)' ; % Membrane viscosity [=] Pa.s.m.
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%% Matrix for fitting results
eps = ones(m, n) ; % Epsilon (Reduced radius) = (2*eta_fluid*R / eta_memb). Dimensionless.
for i = 1 : n
for j = 1 : m
eps(j, i) = 10^(-6) * (2 * eta_fluid * R (j)) / eta_memb (i) ;
end
end

D_fit = ones(m, n) ; % Matrix for D_fit(R) by Petrov Equation for each eta_memb.
for i = 1 : n
for j = 1 : m
D_fit (j, i) = (10^12 * k * T) / (4 * pi * eta_memb(i)) * (log(2 / eps(j, i)) - gamma + 4 * eps(j, i) / pi - ((eps(j, i)^2) / 2) * log(2 / eps(j, i))) / (1 - (eps(j, i)^3 / pi) * log(2 / eps(j, i)) + (c1 * eps(j, i)^b1)
/ (1 + c2 * eps(j, i)^b2)) ; % [=] um2/s
end
end
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$$\hat{D}(\varepsilon) = k_B T/(4\pi\eta) \times [\ln(2/\varepsilon) - \gamma + 4\varepsilon/\pi - (\varepsilon^2/2)\ln(2/\varepsilon)] \times [1 - (\varepsilon^3/\pi)\ln(2/\varepsilon) + c_1\varepsilon^{b_1}/(1 + c_2\varepsilon^{b_2})]^{-1}.$$

Matrix (m x n) for "eps" (epsilon, reduced radius) $\varepsilon = \frac{2\eta_{fluid}R}{\eta_{memb}}$

	$\eta_{memb}(1)$	$\eta_{memb}(2)$	...	$\eta_{memb}(n)$
$R(1)$	$\varepsilon(1,1)$	$\varepsilon(1,2)$	...	$\varepsilon(1,n)$
$R(2)$	...	...	...	$\varepsilon(2,n)$
	...	...	...	...
$R(m)$	$\varepsilon(m,1)$	$\varepsilon(m,2)$	...	$\varepsilon(m,n)$

Matrix (m x n) for "D_fit"

	$\eta_{memb}(1)$	$\eta_{memb}(2)$	...	$\eta_{memb}(n)$
$R(1)$	$D\_fit(1,1)$	$D\_fit(1,2)$	...	$D\_fit(1,n)$
$R(2)$	...	...	...	...
	...	...	...	...
$R(m)$	$D\_fit(m,1)$	$D\_fit(m,2)$	...	$D\_fit(m,n)$