Instructions for the Exponential Fit Command

The command,

[C, La]=PHI_X(*t*,*dt*,*actOPT*),

takes a vector of random times *t* (or any other kind of non-negative observation), and the time increment *dt*, and returns as an output two column vectors, both of length *L*: vector 'C' contains the amplitudes, c_is, and vector 'La' contains the conjugated rates, λ_is, in the optimal exponential expansion of the probability density function that is constructed from the random times. Namely, the command finds the parameters in the optimal expansion of $\phi(t)$ as a sum of exponentials,

$$\phi(t) = \sum_{i=1}^{L} c_i e^{-\lambda_i t} .$$

The subroutine is based on the Padé approximation method with Longman recursion relation. If *actOPT>0*, a maximum likelihood technique is used as a final step in the subroutine. If *actOPT>0*, *C* is a matrix with two columns, $C = [C_{Pade}; C_{MaxLk}]$, and *La* is also a matrix with two columns, $La = [La_{Pade}; La_{MaxLk}]$. The first column in *C*, C_{Pade}, contains the amplitudes obtained from the Padé approximation technique, and the first column in the matrix *La* contains the rates obtained from the Padé approximation technique. The other columns in *C* and *La*, C_{MaxLk} and La_{MaxLk}, contain the amplitudes and rates that are obtained from a maximum likelihood technique initialized by the elements in C_{Pade} and La_{Pade}.

See [1] for further information.

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At a first step, the command is designed to work in Matlab environment, and uses the optimization toolbox in Matlab (setting *actOPT* to zero in the command executes a subroutine that doesn't use the optimization toolbox of Matlab). In the final form, the command will be used through a web-interface that analyzes the signal for web-users. Subscription will be needed for using the web-interface.

Reference:

[1] O. Flomenbom, and R. J. Silbey, *Toolbox for analyzing finite two-state trajectories*, Phys. Rev. E **78**, 066105 (2008).

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