
LAPM Documentation

Release 1.1

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LAPM is a simple Python package to deal with linear autonomous pool models of the form

$$\frac{d}{dt} x(t) = B x(t) + u.$$

It provides symbolic and numerical computation of

- steady state content
- steady state release
- transit time, system age, pool age
 - density
 - (cumulative distribution function)
 - mean
 - standard deviation
 - variance
 - higher order moments
 - (Laplace transforms)

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<i>phase_type</i>	Module for phase-type distribution.
<i>linear_autonomous_pool_model</i>	Module for linear autonomous pool models.
<i>dtmc</i>	Module for discrete-time Markov chains (DTMCs).
<i>example_models</i>	Example linear autonomous pool models.
<i>emanuel</i>	Example: Emanuel's model

1.1 LAPM.phase_type

Module for phase-type distribution.

T is supposed to be a phase-type distributed random variable.

Functions

<code>cum_dist_func(beta, B, Qt)</code>	Return the (symbolic) cumulative distribution function of phase-type.
<code>density(beta, B, Qt)</code>	Return the (symbolic) probability density function of the phase-type distribution.
<code>expected_value(beta, B)</code>	Return the (symbolic) expected value of the phase-type distribution.
<code>laplace(beta, B)</code>	Return the symbolic Laplacian of the phase-type distribution.
<code>nth_moment(beta, B, n)</code>	Return the (symbolic) n th moment of the phase-type distribution.
<code>standard_deviation(beta, B)</code>	Return the (symbolic) standard deviation of the phase-type distribution.
<code>variance(beta, B)</code>	Return the (symbolic) variance of the phase-type distribution.

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<code>z(B)</code>	Return the (symbolic) vector of rates toward absorbing state.
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1.2 LAPM.linear_autonomous_pool_model

Module for linear autonomous pool models.

Classes

<code>LinearAutonomousPoolModel(u, B[, ...])</code>	General class of linear autonomous compartment models.
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Exceptions

<code>Error</code>	Generic error occurring in this module.
<code>NonInvertibleCompartmentalMatrix</code>	

1.3 LAPM.dtmc

Module for discrete-time Markov chains (DTMCs).

Classes

<code>DTMC(beta, P)</code>	Class of discrete time Markov chains.
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Exceptions

<code>Error</code>	Generic error occurring in this module.
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1.4 LAPM.example_models

Example linear autonomous pool models.

Classes

<code>TwoPoolsFeedback(alpha_12, alpha_21, u_1, u_2)</code>	Two-compartment model with feedback.
<code>TwoPoolsFeedbackSimple(alpha, u_1)</code>	Two-compartment model with no feedback.
<code>TwoPoolsNoFeedback(alpha, u_1, u_2)</code>	Two-compartment model with no feedback.

1.5 LAPM.emanuel

Example: Emanuel's model

Functions

<code>emanuel()</code>	Initialize Emanuel's model, show the functionality.
<code>plot_emanuel_ages(EM)</code>	Plot system content versus system age.

CHAPTER 2

Important Note

$\mathbf{B} = (b_{ij})$ has always to be an invertible *compartmental matrix*:

- $b_{ii} < 0$ for all i
 - $b_{ij} \geq 0$ for $i \neq j$
 - $\sum_{i=1}^d b_{ij} \leq 0$ for all j
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CHAPTER 3

Indices and tables

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