

## 1 Magnus expansion for $A, B$ constant and deterministic

We will concern ourselves with the following SDE:

$$dX_t = BX_t dt + AX_t dW_t$$

with

$$A = \begin{bmatrix} 0.335302 & -0.645492 \\ -0.264419 & 0.634641 \end{bmatrix}$$

and

$$B = \begin{bmatrix} -0.0572262 & 0.0493763 \\ -0.665366 & 0.742744 \end{bmatrix}$$

The spectral norm of  $A$  is 1. and the spectral norm of  $B$  is 1.

### 1.1 Parameters

Parameter	value
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$t_0$	0
$T$	1
<code>N_fine</code>	10001
$N$	101
<code>M_fine</code>	1000
$M$	1000
$d$	2

**1.2 Computational Times**

Method	Log	Matrix Exp	Total
Run 1			
euler	0	0	6.98089
m1	0.0087339	0.578909	0.587643
Run 2			
euler	0	0	6.7784
m1	0.0093466	0.535331	0.544678
Run 3			
euler	0	0	6.96439
m1	0.0090311	0.512082	0.521113
Mean Time			
euler	0	0	6.90789
m1	0.0090372	0.542107	0.551144