

## 1 Magnus expansion for $A \in \mathbb{R}^{2,2}$ , $B = 0$ deterministic

We will concern ourselves with the following SDE:

$$dX_t = A_t X_t dW_t$$

with

$$A_t = \begin{bmatrix} f^{11}(t) & f^{12}(t) \\ 0 & f^{22}(t) \end{bmatrix}$$

Here we chose:

$$A_t = \frac{\tilde{A}_t}{\sigma(\tilde{A}_t)},$$

where  $\sigma(A_t)$  is the spectral radius and

$$\tilde{A}_t = \begin{bmatrix} 2 & t \\ 0 & -1 \end{bmatrix}$$

### 1.1 Parameters

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

## 1.2 Computational Times

Method	Log	Matrix Exp	Total
Run 1			
exact	0	0	0.817169
euler	0	0	4.52597
m1	0.0150561	0.532748	0.547804
Run 2			
exact	0	0	0.807434
euler	0	0	4.53311
m1	0.0128825	0.522425	0.535308
Run 3			
exact	0	0	0.80388
euler	0	0	4.57558
m1	0.0126122	0.529183	0.541795
Mean Time			
exact	0	0	0.809494
euler	0	0	4.54488
m1	0.0135169	0.528119	0.541636