

# Matlab Exercise I: Simulating Brownian Motion

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**1**

$$\beta_1 = -\frac{2m + \gamma\Delta t}{m + \gamma\Delta t} \quad (1)$$

$$\beta_2 = \frac{m}{m + \gamma\Delta t} \quad (2)$$

$$\beta_3 = \frac{\sqrt{sk_BT}\gamma}{\sqrt{\Delta t}(m + \gamma\Delta t)} \quad (3)$$

**2**

**3**

Table 1:  $h = 10^3$

Parameter \ L	30	300	3000
$\hat{\kappa}$	8.3	8.4	8.1
$\hat{\sigma}$	$1.8 \times 10^{-9}$	$8.1 \times 10^{-9}$	$2.4 \times 10^{-8}$

Table 2:  $h = 10^4$

Parameter \ L	30	300	3000
$\hat{\kappa}$	$3.8 \times 10^1$	$4.2 \times 10^1$	$4.3 \times 10^1$
$\hat{\sigma}$	$2.1 \times 10^{-9}$	$6.7 \times 10^{-9}$	$2.1 \times 10^{-8}$

Table 3:  $h = 10^5$

Parameter \ L	30	300	3000
$\hat{\kappa}$	$1.6 \times 10^2$	$1.5 \times 10^2$	$1.8 \times 10^2$
$\hat{\sigma}$	$2.0 \times 10^{-9}$	$6.8 \times 10^{-9}$	$2.1 \times 10^{-8}$