



Differential Equation System

Inverter

1 Global Parameters

Parameter	Value	Value Units
vol	7e-016	
N	602299999999999980000000	
k_{B0032}	0.16667	
$k_{const.translation}$	0.00167	
k_{open}	1.5	
$k_{gesloten}$	100	

2 Rate Laws

2.1 Reaction 1

Species	Reactants	Products
	Gene_C0061	mRNA_C0061
	C0012_LacI	Gene_C0061 C0012_LacI

Reaction Rate

$$v_1 = k_{trans_LacI} \cdot \frac{Km^n}{\left(\left(\frac{C0012_LacI}{vol \cdot N}\right)^n + Km^n\right)} \cdot Gene_{C0061} \quad (1)$$

Parameters	Parameter	Value	Value Units
	n	2	
	Km	1e-010	
	k_{trans_LacI}	0.005	

2.2 Reaction 2

Species	Reactants	Products
	mRNA_C0061	C0061_LuxI mRNA_C0061

Reaction Rate

$$v_2 = k_{B0031} \cdot mRNA_{C0061} \quad (2)$$

Parameters	Parameter	Value	Value Units
	k_{B0031}	0.167	

2.3 Reaction 3

Species	Reactants	Products
	EnzymeComplex_LuxI C0061_LuxI	HSL C0061_LuxI

Reaction Rate

$$v_3 = k_{LuxHSL} \cdot C0061_{LuxI} \quad (3)$$

Parameters	Parameter	Value	Value Units
	k_{LuxHSL}	0.16	

2.4 Reaction 4

Species	Reactants	Products
	mRNA_C0061	sa22_degraded

Reaction Rate

$$v_4 = mRNA_{C0061} \cdot d_{mRNA_{C0061}} \quad (4)$$

Parameters	Parameter	Value	Value Units
	$d_{mRNA_{C0061}}$	0.0025	

2.5 Reaction 5

Species	Reactants	Products
	C0061_LuxI	sa23_degraded

Reaction Rate

$$v_5 = C0061_{LuxI} \cdot d_{lva} \quad (5)$$

Parameters	Parameter	Value	Value Units
	d_{lva}	0.0002814	

2.6 Reaction 6

Species	Reactants	Products
	pT7_tag Gene_LacI	closed_mRNA_LacI pT7_tag Gene_LacI

Reaction Rate

$$v_6 = k_{max} \cdot Gene_{LacI} \cdot \frac{pT7_{tag}}{(K_{T7} + pT7_{tag})} \quad (6)$$

Parameters	Parameter	Value	Value Units
	k_{max} K_{T7}	0.044 421	

2.7 Reaction 7

Species	Reactants	Products
	open_mRNA_LacI open_mRNA_LacI_complex	C0012_LacI open_mRNA_LacI open_mRNA_LacI_complex

Reaction Rate

$$v_7 = k_{B0032} \cdot (open_{mRNA_{LacI}} + open_{mRNA_{LacI_complex}}) \quad (7)$$

Parameters	Parameter	Value	Value Units
	$k_{transl_{LacI}}$	0.05	

2.8 Reaction 8

Species	Reactants	Products
	closed_mRNA_LacI	open_mRNA_LacI

Reaction Rate

$$v_8 = k_{open} \cdot closed_{mRNA_LacI} - k_{gesloten} \cdot open_{mRNA_LacI} \quad (8)$$

Parameters	Parameter	Value	Value Units
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2.9 Reaction 9

Species	Reactants	Products
	closed_mRNA_LacI	sa129_degraded

Reaction Rate

$$v_9 = d_{gesloten_mRNA_LacI} \cdot closed_{mRNA_LacI} \quad (9)$$

Parameters	Parameter	Value	Value Units
	$d_{gesloten_mRNA_LacI}$	0.004621	

2.10 Reaction 10

Species	Reactants	Products
	open_mRNA_LacI	sa130_degraded

Reaction Rate

$$v_{10} = d_{open_mRNA_LacI} \cdot open_{mRNA_LacI} \quad (10)$$

Parameters	Parameter	Value	Value Units
	$d_{open_mRNA_LacI}$	0.0023105	

2.11 Reaction 11

Species	Reactants	Products
	open_mRNA_LacI_complex	csa10_degraded

Reaction Rate

$$v_{11} = d_{open_mRNA_LacI_complex} \cdot open_{mRNA_LacI_complex} \quad (11)$$

Parameters	Parameter	Value	Value Units
	$d_{open_mRNA_LacI_complex}$	0.0023105	

2.12 Reaction 12

Species	Reactants	Products
	mRNA_C0061 antimRNA_LuxI	complex LuxI

Reaction Rate

$$v_{12} = mRNAC_{0061} \cdot antimRNA_{LuxI} \cdot k_{complex3} \quad (12)$$

Parameters	Parameter	Value	Value Units
	$k_{complex3}$	2.12	

2.13 Reaction 13

	Reactants	Products
Species	mRNA_RIBOKEY closed_mRNA_LacI	open_mRNA_LacI_complex

Reaction Rate

$$v_{13} = k_{complex2} \cdot mRNA_{RIBOKEY} \cdot closed_{mRNA_LacI} - k_{dis2} \cdot open_{mRNA_LacI_complex} \quad (13)$$

	Parameter	Value	Value Units
Parameters	$k_{complex2}$	57	
	k_{dis2}	100	

3 Equations

3.1 Species: antimRNA_LuxI

$$\frac{d[antimRNA_{LuxI}]}{dt} = -v_{12} \quad (14)$$

3.2 Species: mRNA_RIBOKEY

$$\frac{d[mRNA_{RIBOKEY}]}{dt} = -v_{13} \quad (15)$$

3.3 Species: pT7_tag

$$\frac{d[pT7_{tag}]}{dt} = +v_6 - v_6 \quad (16)$$

3.4 Species: csa10_degraded

$$\frac{d[csa10_{degraded}]}{dt} = +v_{11} \quad (17)$$

3.5 Species: C0012_LacI

$$\frac{d[C0012_{LacI}]}{dt} = +v_1 - v_1 + v_7 \quad (18)$$

3.6 Species: sa130_degraded

$$\frac{d[sa130_{degraded}]}{dt} = +v_{10} \quad (19)$$

3.7 Species: open_mRNA_LacI

$$\frac{d[open_{mRNA_LacI}]}{dt} = +v_7 - v_7 + v_8 - v_{10} \quad (20)$$

3.8 Species: closed_mRNA_LacI

$$\frac{d[closed_{mRNA_LacI}]}{dt} = +v_6 - v_8 - v_9 - v_{13} \quad (21)$$

3.9 Species: sa129_degraded

$$\frac{d[sa129_{degraded}]}{dt} = +v_9 \quad (22)$$

3.10 Species: Gene_LacI

$$\frac{d[Gene_{LacI}]}{dt} = +v_6 - v_6 \quad (23)$$

3.11 Species: Gene_C0061

$$\frac{d[Gene_{C0061}]}{dt} = +v_1 - v_1 \quad (24)$$

3.12 Species: mRNA_C0061

$$\frac{d[mRNA_{C0061}]}{dt} = +v_1 + v_2 - v_2 - v_4 - v_{12} \quad (25)$$

3.13 Species: sa22_degraded

$$\frac{d[sa22_{degraded}]}{dt} = +v_4 \quad (26)$$

3.14 Species: C0061_LuxI

$$\frac{d[C0061_{LuxI}]}{dt} = +v_2 + v_3 - v_3 - v_5 \quad (27)$$

3.15 Species: sa23_degraded

$$\frac{d[sa23_{degraded}]}{dt} = +v_5 \quad (28)$$

3.16 Species: EnzymeComplex_LuxI

$$\frac{d[EnzymeComplex_{LuxI}]}{dt} = -v_3 \quad (29)$$

3.17 Species: HSL

$$\frac{d[HSL]}{dt} = +v_3 \quad (30)$$

3.18 Species: complex LuxI

$$\frac{d[complex_{LuxI}]}{dt} = +v_{12} \quad (31)$$

3.19 Species: open_mRNA_LacI_complex

$$\frac{d[open_{mRNA-LacI-complex}]}{dt} = +v_7 - v_7 - v_{11} + v_{13} \quad (32)$$

4 Compartments

4.1 Inverter

Species	Initial Amount	Initial Amount Units
antimRNA_LuxI	0	
mRNA_RIBOKEY	0	
pT7_tag	0	
csa10_degraded	0	
C0012_LacI	0	
sa130_degraded	0	
open_mRNA_LacI	0	
closed_mRNA_LacI	0	
sa129_degraded	0	
Gene_LacI	1	
Gene_C0061	1	
mRNA_C0061	0	
sa22_degraded	0	
C0061_LuxI	0	
sa23_degraded	0	
EnzymeComplex_LuxI	0	
HSL	0	
complex LuxI	0	
open_mRNA_LacI_complex	0	