

Table 1 Variables and parameters of the mathematical model

| | Description | Value | Units | |
|-------------------|--|------------------------------|--------------------|--------------------|
| I | IPTG concentration | | mM | |
| G | Concentration of GFP protein | | molecules per cell | |
| L^F | Free LacI molecules, i.e. not bound to operator sites or IPTG molecule | | molecules per cell | |
| L^I | LacI molecules bound to IPTG | | molecules per cell | |
| M_G | mRNA molecules of GFP | | molecules per cell | |
| M_L | mRNA molecules of LacI | | molecules per cell | |
| $D_{G/L}^F$ | Free <i>Repressor/Reporter</i> plasmids | | plasmids per cell | |
| $D_{G/L}^L$ | <i>Repressor/Reporter</i> plasmids bound to LacI molecules | | plasmids per cell | |
| $D_{G/L}^I$ | <i>Repressor/Reporter</i> plasmids bound to induced LacI molecules | | plasmids per cell | |
| D_G^0 | Number of <i>Reporter</i> plasmids per cell | 80 | plasmids per cell | |
| D_L^0 | Number of <i>Repressor</i> plasmids per cell | $D_G^0 / 3.75^6 = 21.33$ | plasmids per cell | |
| $\lambda_{G/L}$ | Protein degradation rate | 0.0214^6 | min^{-1} | |
| $\lambda_{G/L}^M$ | mRNA degradation rate | 0.271 [39] | min^{-1} | |
| α_G | GFP rate of synthesis | $540\lambda_G = 11.54[40]$ | min^{-1} | |
| A_L | LacI rate of synthesis | $\alpha_G/4 = 2.88$ | min^{-1} | |
| α_G^M | GFP transcription rate | 0.56^{\dagger} | min^{-1} | |
| α_L^M | LacI transcription rate | $\alpha_G^M / 1.23^6 = 0.45$ | min^{-1} | |
| K_x^L | Equilibrium binding constant of the complex LacI- O_x | K_1^L | 0.13 [41] | molecules per cell |
| | | K_2^L | 1.63 [41] | molecules per cell |
| | | K_3^L | 0.0394^{\dagger} | molecules per cell |
| K_x^I | Equilibrium binding constant for the binding of induced LacI molecule to the operator sequence O_x | K_1^I | 25336^{\dagger} | molecules per cell |
| | | K_2^I | ∞ | molecules per cell |
| | | K_3^I | 313^{\dagger} | molecules per cell |
| K^{II} | Equilibrium binding constant for the binding IPTG-LacI | 0.2890^{\dagger} | mM | |
| n | Cooperativity of the binding LacI-IPTG | 1.8688^{\dagger} | | |
| τ^{LI} | Time constant of LacI binding to the operator sequences | 0.02 [43] | min | |
| τ^{DI} | Time constant of induced-LacI binding to the operator sequences | * | min | |
| τ^{DL} | Time constant of the binding LacI-IPTG | * | min | |

* Only the steady-state behaviors of the gene circuits are analyzed, thus arbitrary values can be used for these time constants. [†]Values defined through the fitting procedure. ⁶Values obtained by experimental measurements. References are included for the values retrieved from the literature.