specific to pTet-circuit

$$pTet \xrightarrow{b_1} FlhDC + pTet \tag{1}$$

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specific to pFlhDC-circuit

$$pFlhDC \xrightarrow{b_2} FlhDC + pFlhDC \tag{2}$$

$$n_3 FlhDC + pFliA \underset{k_{-3}}{\overset{k_3}{\rightleftharpoons}} (FlhDC)_{n_3} \bowtie pFliA \qquad K_3^{n_3} = \frac{k_{-3}}{k_3} \tag{3}$$

$$n_4 FlhDC + pFlhB \underset{k_{-4}}{\overset{k_4}{\rightleftharpoons}} (FlhDC)_{n_4} \bowtie pFlhB \qquad K_4^{n_4} = \frac{k_{-4}}{k_4} \tag{4}$$

$$(FlhDC)_{n_3} \bowtie pFliA \xrightarrow{b_5} FliA + (FlhDC)_{n_3} \bowtie pFliA \tag{5}$$

$$(FlhDC)_{n_4} \bowtie pFlhB \xrightarrow{b_6} FP3 + (FlhDC)_{n_4} \bowtie pFlhDC \tag{6}$$

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specific to pTet-circuit

$$(FlhDC)_{n_4} \bowtie pFlhB \xrightarrow{b_6} TetR + (FlhDC)_{n_4} \bowtie pFlhB \tag{7}$$

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specific to pFlhDC/OmpR*-circuit

$$(FlhDC)_{n_4} \bowtie pFlhB \xrightarrow{b_6} OmpR^* + (FlhDC)_{n_4} \bowtie pFlhB \tag{8}$$

specific to pFlhDC/EnvZ-circuit

$$(FlhDC)_{n_4} \bowtie pFlhB \xrightarrow{b_6} EnvZ + (FlhDC)_{n_4} \bowtie pFlhB \tag{9}$$

$$n_{10} FliA + pFliA \underset{k_{-10}}{\overset{k_{10}}{\rightleftharpoons}} (FliA)_{n_{10}} \bowtie pFliA \qquad K_{10}^{n_{10}} = \frac{k_{-10}}{k_{10}} \tag{10}$$

$$n_{11} FliA + pFlhB \underset{k_{-11}}{\overset{k_{11}}{\rightleftharpoons}} (FliA)_{n_{11}} \bowtie pFlhB \qquad K_{11}^{n_{11}} = \frac{k_{-11}}{k_{11}} \tag{11}$$

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specific to pFlhDC-circuit

$$n_{12} FliA + pFlhDC \underset{k_{-12}}{\overset{k_{12}}{\rightleftharpoons}} (FliA)_{n_{12}} \bowtie pFlhDC \qquad K_{12}^{n_{12}} = \frac{k_{-12}}{k_{12}} \tag{12}$$

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specific to pFlhDC-circuit

$$(FliA)_{n_{12}} \bowtie pFlhDC \xrightarrow{b_{13}} FlhDC + (FliA)_{n_{12}} \bowtie pFlhDC \tag{13}$$

$$(FliA)_{n_{10}} \bowtie pFliA \xrightarrow{b_{14}} FliA + (FliA)_{n_{10}} \bowtie pFliA \tag{14}$$

$$(FliA)_{n_{11}} \bowtie pFlhB \xrightarrow{b_{15}} FP3 + (FliA)_{n_{11}} \bowtie pFlhB \tag{15}$$

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specific to pTet-circuit

$$(FliA)_{n_{11}} \bowtie pFlhB \xrightarrow{b_{15}} TetR + (FliA)_{n_{11}} \bowtie pFlhB \tag{16}$$

specific to pFlhDC-circuit

$$(FliA)_{n_{11}} \bowtie pFlhB \xrightarrow{b_{15}} OmpR^* + (FliA)_{n_{11}} \bowtie pFlhB \tag{17}$$

specific to pFlhDC/EnvZ-circuit

$$(FliA)_{n_{11}} \bowtie pFlhB \xrightarrow{b_{15}} EnvZ + (FliA)_{n_{11}} \bowtie pFlhB \tag{18}$$

specific to pTet-circuit

$$n_{19} aTc + TetR \underset{k_{-19}}{\overset{k_{19}}{\rightleftharpoons}} (aTc)_{n_{19}} \bowtie TetR \qquad K_{19} = \frac{k_{-19}}{k_{19}} \tag{19}$$

specific to pTet-circuit

$$n_{20} TetR + pTet \underset{k_{-20}}{\overset{k_{20}}{\rightleftharpoons}} (TetR)_{n_{20}} \bowtie pTet \qquad K_{20}^{n_{20}} = \frac{k_{-20}}{k_{20}} \tag{20}$$

specific to pFlhDC/EnvZ-circuit

$$n_{21} EnvZ + OmpR \underset{k_{-21}}{\overset{k_{21}}{\rightleftharpoons}} OmpR^* \qquad K_{21} = \frac{k_{-21}}{k_{21}} \tag{21}$$

specific to pFlhDC-circuit

$$n_{22} OmpR^* + pFlhDC \underset{k_{-22}}{\overset{k_{22}}{\rightleftharpoons}} (OmpR^*)_{n_{22}} \bowtie pFlhDC \qquad K_{22}^{n_{22}} = \frac{k_{-22}}{k_{22}} \tag{22}$$

$$FlhDC \xrightarrow{\gamma_{23}} \emptyset \tag{23}$$

$$FliA \xrightarrow{\gamma_{24}} \emptyset \tag{24}$$

$$FP3 \xrightarrow{\gamma_{25}} \emptyset \tag{25}$$

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specific to pTet-circuit

$$TetR \xrightarrow{\gamma_{26}} \emptyset \tag{26}$$

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specific to pTet-circuit

$$(aTc)_{n_{19}} \bowtie TetR \xrightarrow{\gamma_{27}} \emptyset \qquad K_{19}^{n_{19}} = K_{19}^{eff} = K_{19} + \frac{\gamma_{27}}{k_{19}} \tag{27}$$

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specific to pFlhDC/EnvZ-circuit

$$EnvZ \xrightarrow{\gamma_{28}} \emptyset \tag{28}$$

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specific to pFlhDC-circuit

$$OmpR^{*} \xrightarrow{\gamma_{29}} \emptyset \qquad K_{21}^{eff} = K_{21} + \frac{\gamma_{29}}{k_{21}} \tag{29}$$

$$(3) \Rightarrow \qquad [(FlhDC)_{n_3} \bowtie pFliA]_{eq} = \frac{[FlhDC]^{n_3}}{K_3^{n_3} + [FlhDC]^{n_3}} \cdot [pFliA^{total}] \tag{30}$$

$$(4) \Rightarrow \qquad [(FlhDC)_{n_4} \bowtie pFlhB]_{eq} = \frac{[FlhDC]^{n_4}}{K_4^{n_4} + [FlhDC]^{n_4}} \cdot [pFlhB^{total}] \tag{31}$$

$$(10) \Rightarrow \qquad [(FliA)_{n_{10}} \bowtie pFliA]_{eq} = \frac{[FliA]^{n_{10}}}{K_{10}^{n_{10}} + [FliA]^{n_{10}}} \cdot [pFliA^{total}] \tag{32}$$

$$(11) \Rightarrow \qquad [(FliA)_{n_{11}} \bowtie pFlhB]_{eq} = \frac{[FliA]^{n_{11}}}{K_{11}^{n_{11}} + [FliA]^{n_{11}}} \cdot [pFlhB^{total}] \tag{33}$$

specific to pFlhDC-circuit

$$(12) \Rightarrow \qquad [(FliA)_{n_{12}} \bowtie pFlhDC]_{eq} = \frac{[FliA]^{n_{12}}}{K_{12}^{n_{12}} + [FliA]^{n_{12}}} \cdot [pFlhDC^{total}] \tag{34}$$

specific to pTet-circuit

$$\begin{matrix}(19)\\(27)\end{matrix} \Rightarrow \qquad [TetR^{free}] = \frac{K_{19}^{n_{aTc}}}{K_{19}^{n_{aTc}} + [aTc]_i^{n_{aTc}}} \cdot [TetR^{total}] \tag{35}$$

specific to pTet-circuit

$$(20) \Rightarrow \qquad [pTet]_{eq} = \frac{K_{20}^{n_{20}}}{K_{20}^{n_{20}} + [TetR^{free}]^{n_{20}}} \cdot [pTet^{total}] \tag{36}$$

specific to pFlhDC/EnvZ-circuit

$$\begin{matrix}(21)\\(29)\end{matrix} \Rightarrow \begin{cases} \left([EnvZ^{total}] - n_{21} OmpR^*_{eq}\right)^{n_{21}} \left([OmpR^{total}] - OmpR^*_{eq}\right) - K_{21}^{eff} OmpR^*_{eq} = 0 \\ 0 < n_{21} OmpR^*_{eq} \qquad ; \qquad 0 < OmpR^*_{eq} < [OmpR^{total}] \end{cases} \tag{37}$$

specific to pFlhDC-circuit

$$(22) \Rightarrow \qquad [pFlhDC]_{eq} = \frac{K_{22}^{n_{22}}}{K_{22}^{n_{22}} + [OmpR^*]^{n_{22}}} \cdot [pFlhDC^{total}] \tag{38}$$

specific to pTet-circuit

$$\begin{matrix}(1)\\(23)\end{matrix} \Rightarrow \frac{d[FlhDC]}{dt} = b_1[pTet]_{eq} - \gamma_{23}[FlhDC] \tag{39a}$$

$$\begin{matrix}(35)\\(36)\end{matrix} \Rightarrow \frac{d[FlhDC]}{dt} = \beta_1 \cdot \frac{K_{20}^{n_{20}}}{K_{20}^{n_{20}} + \left(\frac{K_{19}^{n_{aTc}}}{K_{19}^{n_{aTc}} + [aTc]_i^{n_{aTc}}} \cdot [TetR]\right)^{n_{20}}} - \gamma_{23}[FlhDC] \tag{39}$$

specific to pFlhDC-circuit

$$\begin{matrix}(2)\\(13)\\(23)\end{matrix} \Rightarrow \frac{d[FlhDC]}{dt} = b_2[pFlhDC^{free}]_{eq} + b_{13}[(FliA)_{n_{12}} \bowtie pFlhDC]_{eq} - \gamma_{23}[FlhDC] \tag{40a}$$

$$\begin{matrix}(34)\\(38)\end{matrix} \Rightarrow \frac{d[FlhDC]}{dt} = \frac{K_{22}^{n_{22}}}{K_{22}^{n_{22}} + [OmpR^*]^{n_{22}}} \left(\beta_2 \cdot \frac{K_{12}^{n_{12}}}{K_{12}^{n_{12}} + [FliA]^{n_{12}}} + \beta_{13} \cdot \frac{[FliA]^{n_{12}}}{K_{12}^{n_{12}} + [FliA]^{n_{12}}}\right) - \gamma_{23}[FlhDC] \tag{40}$$

$$\begin{matrix}(5)\\(14)\\(24)\end{matrix} \Rightarrow \frac{d[FliA]}{dt} = b_5[(FlhDC)_{n_3} \bowtie pFliA]_{eq} + b_{14}[(FliA)_{n_{10}} \bowtie pFliA]_{eq} - \gamma_{24}[FliA] \tag{41a}$$

$$\begin{matrix}(30)\\(32)\end{matrix} \Rightarrow \frac{d[FliA]}{dt} = \beta_5 \cdot \frac{[FlhDC]^{n_3}}{K_3^{n_3} + [FlhDC]^{n_3}} + \beta_{14} \cdot \frac{[FliA]^{n_{10}}}{K_{10}^{n_{10}} + [FliA]^{n_{10}}} - \gamma_{24}[FliA] \tag{41}$$

$$\begin{matrix}(6)\\(15)\\(25)\end{matrix} \Rightarrow \frac{d[FP3]}{dt} = b_6[(FlhDC)_{n_4} \bowtie pFlhB]_{eq} + b_{15}[(FliA)_{n_{11}} \bowtie pFlhB]_{eq} - \gamma_{25}[FP3] \tag{42a}$$

$$\begin{matrix}(31)\\(33)\end{matrix} \Rightarrow \frac{d[FP3]}{dt} = \beta_6 \cdot \frac{[FlhDC]^{n_4}}{K_4^{n_4} + [FlhDC]^{n_4}} + \beta_{15} \cdot \frac{[FliA]^{n_{11}}}{K_{11}^{n_{11}} + [FliA]^{n_{11}}} - \gamma_{25}[FP3] \tag{42}$$

specific to pTet-circuit

$$\begin{matrix}(7)\\(16)\\(26)\end{matrix} \Rightarrow \frac{d[TetR]}{dt} = b_6[(FlhDC)_{n_4} \bowtie pFlhB]_{eq} + b_{15}[(FliA)_{n_{11}} \bowtie pFlhB]_{eq} - \gamma_{26}[TetR] \tag{43a}$$

$$\begin{matrix}(31)\\(33)\end{matrix} \Rightarrow \frac{d[TetR]}{dt} = \beta_6 \cdot \frac{[FlhDC]^{n_4}}{K_4^{n_4} + [FlhDC]^{n_4}} + \beta_{15} \cdot \frac{[FliA]^{n_{11}}}{K_{11}^{n_{11}} + [FliA]^{n_{11}}} - \gamma_{26}[TetR] \quad (43)$$

eqn.(35) *gives then* $[TetR^{free}]$ *in function of* $[TetR^{total}] := [TetR]$

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specific to pFlhDC/EnvZ-circuit

$$\begin{matrix}(9)\\(18)\\(28)\end{matrix} \Rightarrow \frac{d[EnvZ]}{dt} = b_6[(FlhDC)_{n_4} \bowtie pFlhB]_{eq} + b_{15}[(FliA)_{n_{11}} \bowtie pFlhB]_{eq} - \gamma_{28}[EnvZ] \quad (44a)$$

$$\begin{matrix}(31)\\(33)\end{matrix} \Rightarrow \frac{d[EnvZ]}{dt} = \beta_6 \cdot \frac{[FlhDC]^{n_4}}{K_4^{n_4} + [FlhDC]^{n_4}} + \beta_{15} \cdot \frac{[FliA]^{n_{11}}}{K_{11}^{n_{11}} + [FliA]^{n_{11}}} - \gamma_{28}[EnvZ] \quad (44b)$$

$$[EnvZ^{total}] = [EnvZ_b] + [EnvZ] \quad (44)$$

Solve then eqn.(37) *to get* $[OmpR^*]$ *in function of* $[OmpR^{total}] := [OmpR_b]$

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specific to pFlhDC/OmpR*-circuit

$$\begin{matrix}(8)\\(17)\\(29)\end{matrix} \Rightarrow \frac{d[OmpR^*]}{dt} = b_6[(FlhDC)_{n_4} \bowtie pFlhB]_{eq} + b_{15}[(FliA)_{n_{11}} \bowtie pFlhB]_{eq} - \gamma_{29}[OmpR^*] \quad (45a)$$

$$\begin{matrix}(31)\\(33)\end{matrix} \Rightarrow \frac{d[OmpR^*]}{dt} = \beta_6 \cdot \frac{[FlhDC]^{n_4}}{K_4^{n_4} + [FlhDC]^{n_4}} + \beta_{15} \cdot \frac{[FliA]^{n_{11}}}{K_{11}^{n_{11}} + [FliA]^{n_{11}}} - \gamma_{29}[OmpR^*] \quad (45)$$