

Structure of pHs BJTAMP

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1 System netlist

line	label	dictionary.component	nodes	parameters
ℓ_1	IN	electronics.source	('IN',)	{ type voltage
ℓ_2	Cin	electronics.capacitor	('IN', '5')	{ C ('Cin', 1e-05)
ℓ_3	Rbc	electronics.resistor	('5', '6')	{ R ('Rcd', 270000.0)
ℓ_4	BJT	electronics.bjt	('5', '6', 'ref')	{ mu ('mu', 1.006) betaF ('betaF', 294.3) Vt ('Vt', 0.026) betaR ('betaR', 7.946) Rb ('Rb', 1) Rc ('Rc', 0.85) Is ('Is', 2.39e-14) Re ('Re', 0.4683)
ℓ_5	Rcd	electronics.resistor	('vcc', '6')	{ R ('Rcd', 1000.0)
ℓ_6	VCC	electronics.source	('vcc',)	{ type voltage
ℓ_7	Cout	electronics.capacitor	('OUT', '6')	{ C ('Cout', 1e-05)
ℓ_8	OUT	electronics.source	('OUT',)	{ type current

$\dim(\mathbf{x}) = n_{\mathbf{x}} = 2;$

$\dim(\mathbf{w}) = n_{\mathbf{w}} = 7;$

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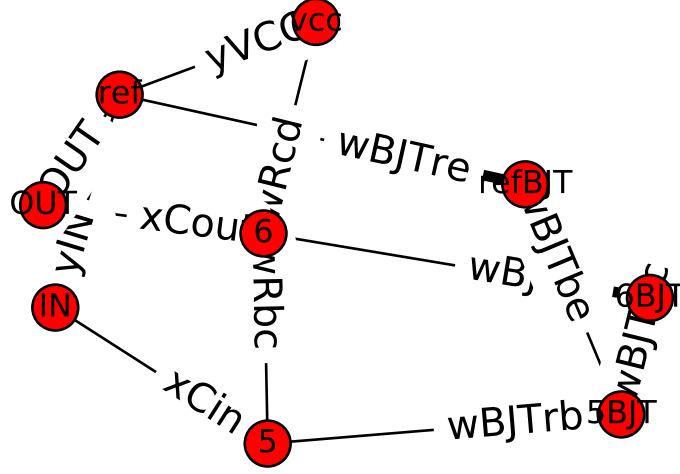


Figure 1: Graph of system BJTAMP.

$$\begin{aligned}\dim(\mathbf{y}) &= n_{\mathbf{y}} = 3; \\ \dim(\mathbf{p}) &= n_{\mathbf{p}} = 0;\end{aligned}$$

2 System variables

$$\begin{aligned}\text{State variable } \mathbf{x} &= \begin{pmatrix} x_{\text{Cin}} \\ x_{\text{Cout}} \end{pmatrix}; \\ \text{Dissipation variable } \mathbf{w} &= \begin{pmatrix} w_{\text{Rcd}} \\ w_{\text{BJTbe}} \\ w_{\text{BJTbc}} \\ w_{\text{BJTre}} \\ w_{\text{BJTrc}} \\ w_{\text{BJTrb}} \\ w_{\text{Rbc}} \end{pmatrix};\end{aligned}$$

$$\begin{aligned} \text{Input } \mathbf{u} &= \begin{pmatrix} u_{\text{IN}} \\ u_{\text{VCC}} \\ u_{\text{OUT}} \end{pmatrix}; \\ \text{Output } \mathbf{y} &= \begin{pmatrix} y_{\text{IN}} \\ y_{\text{VCC}} \\ y_{\text{OUT}} \end{pmatrix}; \end{aligned}$$

3 Constitutive relations

$$\text{Hamiltonian } H(\mathbf{x}) = \frac{0.5}{C_{\text{out}}} \cdot x_{\text{Cout}}^2 + \frac{0.5}{C_{\text{in}}} \cdot x_{\text{Cin}}^2;$$

$$\text{Hamiltonian gradient } \nabla H(\mathbf{x}) = \begin{pmatrix} \frac{1.0}{C_{\text{in}}} \cdot x_{\text{Cin}} \\ \frac{1.0}{C_{\text{out}}} \cdot x_{\text{Cout}} \end{pmatrix};$$

[illegible]

$$\text{Jacobian of dissipation function } \mathcal{J}_{\mathbf{z}}(\mathbf{w}) = \begin{pmatrix} \frac{1}{\text{Rcd}} & 0 & 0 \\ 0 & \frac{1}{\text{betaF}} \cdot (\text{betaF} + 1) \cdot \left(\frac{\text{Is} \cdot e^{\frac{w_{\text{BJTbe}}}{\text{Vt} \cdot \text{mu}}}}{\text{Vt} \cdot \text{mu}} + 1.0 \cdot 10^{-9} \right) & -\frac{1}{\text{betaR}} \cdot (\text{betaR} + 1) \cdot \left(\frac{\text{Is} \cdot e^{\frac{w_{\text{BJTbe}}}{\text{Vt} \cdot \text{mu}}}}{\text{Vt} \cdot \text{mu}} + 1.0 \cdot 10^{-9} \right) \\ 0 & -\frac{\text{Is} \cdot e^{\frac{w_{\text{BJTbe}}}{\text{Vt} \cdot \text{mu}}}}{\text{Vt} \cdot \text{mu}} - 1.0 \cdot 10^{-9} & \frac{1}{\text{betaR}} \cdot (\text{betaR} + 1) \cdot \left(\frac{\text{Is} \cdot e^{\frac{w_{\text{BJTbe}}}{\text{Vt} \cdot \text{mu}}}}{\text{Vt} \cdot \text{mu}} + 1.0 \cdot 10^{-9} \right) \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

4 System parameters

4.1 Constant

parameter	value (SI)
betaF :	294.3
betaR :	7.946
Rb :	1
Rcd :	1000.0
Re :	0.4683
Vt :	0.026
Cin :	1e-05
mu :	1.006
Is :	2.39e-14
Cout :	1e-05
Rc :	0.85

$$\mathbf{J} = \begin{pmatrix} 0 & 0 & -1.0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1.0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \\ 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 1.0 & -1.0 & 0 \\ -1.0 & 0 & 0 & 0 & 0 & 1.0 & 0 & -1.0 & 0 & -1.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & -1.0 & 1.0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1.0 & 0 & -1.0 & 0 & 0 & 0 & 0 & 0 & 0 & -1.0 \\ 0 & 0 & -1.0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1.0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1.0 & -1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 1.0 & 0 & 0 \end{pmatrix};$$