DLC

The PyPHS* development team[1]

[1]Project-team S3†, STMS, IRCAM-CNRS-UPMC (UMR 9912), 1 Place Igor-Stravinsky, 75004 Paris, France

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1 System netlist

line	label	dictionary.component	nodes	parameters
ℓ_1	in	electronics.source	('#', 'n1')	type voltage
ℓ_2	D	electronics.diode	('n1', 'n2')	v0 ('v0', 0.026) mu ('mu', 1.7) Is ('Is', 2e-09) R ('Rd', 0.5)
ℓ_3	L	electronics.inductor	('n2', 'n3')	L ('L', 0.05)
ℓ_4	C	electronics.capacitor	('n3', '#')	C ('C', 2e-06)

2 System dimensions

$\dim(\mathbf{x}) = n_{\mathbf{x}} = 2;$
$\dim(\mathbf{w}) = n_{\mathbf{w}} = 3;$
$\dim(\mathbf{y}) = n_{\mathbf{y}} = 1;$
$\dim(\mathbf{p}) = n_{\mathbf{p}} = 0;$

*https://github.com/afalaize/pyphs
†http://s3.ircam.fr

3 System variables

State variable $\mathbf{x} = \begin{pmatrix} x_{\mathrm{L}} \\ x_{\mathrm{C}} \end{pmatrix}$;
Dissipation variable $\mathbf{w} = \begin{pmatrix} w_{\mathrm{D}} \\ w_{\mathrm{D_R}} \\ w_{\mathrm{D_g min}} \end{pmatrix}$;
Input $\mathbf{u} = \begin{pmatrix} u_{\mathrm{in}} \end{pmatrix}$;
Output $\mathbf{y} = \begin{pmatrix} y_{\mathrm{in}} \end{pmatrix}$;

4 Constitutive relations

Hamiltonian $\mathtt{H}(\mathbf{x}) = \frac{0.5}{L} \cdot x_{\mathrm{L}}^2 + \frac{0.5}{C} \cdot x_{\mathrm{C}}^2$;
Hamiltonian gradient $\nabla\mathtt{H}(\mathbf{x}) = \begin{pmatrix} \frac{1.0}{L} \cdot x_{\mathrm{L}} \\ \frac{1.0}{C} \cdot x_{\mathrm{C}} \end{pmatrix}$;
Dissipation function $\mathbf{z}(\mathbf{w}) = \begin{pmatrix} \mu \cdot v_0 \cdot \log\left(\frac{1}{Is} \cdot (Is + w_{\mathrm{D}})\right) \\ Rd \cdot w_{\mathrm{D_R}} \\ \frac{w_{\mathrm{D_g min}}}{gmin} \end{pmatrix}$;
Jacobian of dissipation function $\mathcal{J}_{\mathbf{z}}(\mathbf{w}) = \begin{pmatrix} \frac{\mu \cdot v_0}{Is + w_{\mathrm{D}}} & 0 & 0 \\ 0 & Rd & 0 \\ 0 & 0 & \frac{1}{gmin} \end{pmatrix}$;

5 System parameters

5.1 Constant

parameter	value (SI)
C :	2e-06
v0 :	0.026
L :	0.05
mu :	1.7
gmin :	1e-12
Is :	2e-09
Rd :	0.5

6 System structure

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

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

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

$$\mathbf{M_{xy}} = \begin{pmatrix} -1.0 \\ 0 \end{pmatrix};$$

$$\mathbf{M_{wx}} = \begin{pmatrix} 0 & 0 \\ 1.0 & 0 \\ 1.0 & 0 \end{pmatrix};$$

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

$$\mathbf{M_{wy}} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix};$$

$$\mathbf{M_{yx}} = \begin{pmatrix} 1.0 & 0 \end{pmatrix};$$

$$\mathbf{M_{yw}} = \begin{pmatrix} 0 & 0 & 0 \end{pmatrix};$$

$$\mathbf{M_{yy}} = \begin{pmatrix} 0 \end{pmatrix};$$

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

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

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

$$\mathbf{J_{xy}} = \begin{pmatrix} -1.0 \\ 0 \end{pmatrix};$$

$$\mathbf{J_{ww}} = \begin{pmatrix} 0 & 0 & 1.0 \\ 0 & 0 & 0 \\ -1.0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{J_{wy}} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix};$$
$$\mathbf{J_{yy}} = \begin{pmatrix} 0 \end{pmatrix};$$

$$\mathbf{R} = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{xx}} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{xw}} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{xy}} = \begin{pmatrix} 0 \\ 0 \end{pmatrix};$$
$$\mathbf{R_{ww}} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{wy}} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix};$$
$$\mathbf{R_{yy}} = \begin{pmatrix} 0 \end{pmatrix};$$