Structure of pHs `ThieleSmall`

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October 8, 2016

1 System netlist

line	label	dictionary.component	nodes	parameters
ℓ_1	IN	electronics.source	('A', 'ref')	{ type voltage
ℓ_2	R	electronics.resistor	('A', 'B')	{ R ('R', 1000.0)
ℓ_3	L	electronics.inductor	('B', 'C')	{ L ('L', 0.05)
ℓ_4	G	connectors.gyrator	('C', 'ref', 'D', 'ref')	{ alpha ('Bl', 5)
ℓ_5	M	mechanics.mass	('D', 'E')	{ M ('M', 0.1)
ℓ_6	K	mechanics.stiffness	('E', 'F')	{ K ('K', 5000.0)
ℓ_7	A	mechanics.damper	('F', 'ref')	{ A ('A', 1)

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

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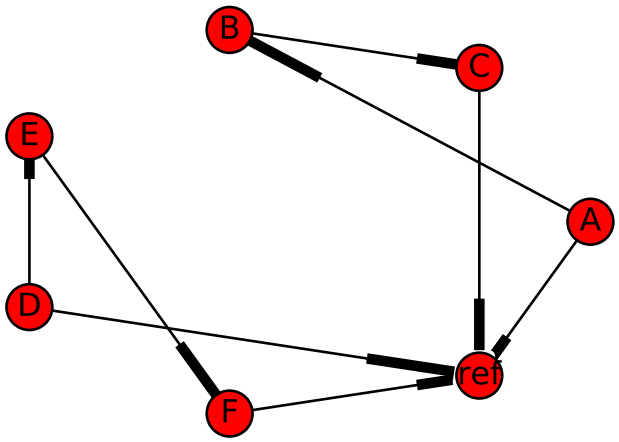

Figure 1: Graph of system `ThieleSmall`.

2 System variables

State variable $\mathbf{x} = \begin{pmatrix} x_{\mathrm{M}} \\ x_{\mathrm{L}} \\ x_{\mathrm{K}} \end{pmatrix}$;

Dissipation variable $\mathbf{w} = \begin{pmatrix} w_{\mathrm{R}} \\ w_{\mathrm{A}} \end{pmatrix}$;

Input $\mathbf{u} = \begin{pmatrix} u_{\mathrm{IN}} \end{pmatrix}$;

Output $\mathbf{y} = \begin{pmatrix} y_{\mathrm{IN}} \end{pmatrix}$;

3 Constitutive relations

Hamiltonian $\mathtt{H}(\mathbf{x}) = 0.5 \cdot \mathrm{K} \cdot x_{\mathrm{K}}^2 + \frac{0.5}{\mathrm{M}} \cdot x_{\mathrm{M}}^2 + \frac{0.5}{\mathrm{L}} \cdot x_{\mathrm{L}}^2$;

Hamiltonian gradient $\nabla\mathtt{H}(\mathbf{x}) = \begin{pmatrix} \frac{1.0}{\mathrm{M}} \cdot x_{\mathrm{M}} \\ \frac{1.0}{\mathrm{L}} \cdot x_{\mathrm{L}} \\ 1.0 \cdot \mathrm{K} \cdot x_{\mathrm{K}} \end{pmatrix}$;

Dissipation function $\mathbf{z}(\mathbf{w}) = \begin{pmatrix} \mathrm{R} \cdot w_{\mathrm{R}} \\ \mathrm{A} \cdot w_{\mathrm{A}} \end{pmatrix}$;

Jacobian of dissipation function $\mathcal{J}_{\mathbf{z}}(\mathbf{w}) = \begin{pmatrix} \mathrm{R} & 0 \\ 0 & \mathrm{A} \end{pmatrix}$;

4 System parameters

4.1 Constant

parameter	value (SI)
Bl :	5
R :	1000.0
L :	0.05
A :	1
K :	5000.0
M :	0.1

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

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

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