Structure of the port-Hamiltonian system
RLC

The PyPHS* development team[1]

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1 System dimensions

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

2 System variables

State variable $\mathbf{x} = \begin{pmatrix} x_{\mathrm{L}} \\ x_{\mathrm{C}} \end{pmatrix};$
Dissipation variable $\mathbf{w} = \begin{pmatrix} w_{\mathrm{R}} \end{pmatrix};$
Input $\mathbf{u} = \begin{pmatrix} u_{\mathrm{out}} \end{pmatrix};$
Output $\mathbf{y} = \begin{pmatrix} y_{\mathrm{out}} \end{pmatrix};$

*`https://github.com/A-Falaize/pyphs`
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3 Constitutive relations

Hamiltonian $\mathtt{H}(\mathbf{x}) = \frac{x_{\mathrm{L}}^2}{2\cdot\mathrm{L}} + \frac{x_{\mathrm{C}}^2}{2\cdot\mathrm{C}}$;
Hamiltonian gradient $\nabla\mathtt{H}(\mathbf{x}) = \begin{pmatrix} \frac{x_{\mathrm{L}}}{\mathrm{L}} \\ \frac{x_{\mathrm{C}}}{\mathrm{C}} \end{pmatrix}$;
Dissipation function $\mathbf{z}(\mathbf{w}) = \begin{pmatrix} \mathrm{R}\cdot w_{\mathrm{R}} \end{pmatrix}$;
Jacobian of dissipation function $\mathcal{J}_{\mathbf{z}}(\mathbf{w}) = \begin{pmatrix} \mathrm{R} \end{pmatrix}$;

4 System parameters

4.1 Constant

parameter	value (SI)
C :	2e-09
R :	1000.0
L :	0.05

5 System structure

$$\mathbf{M} = \begin{pmatrix} 0 & -1 & -1 & -1 \\ 1 & 0 & 0 & 0 \\ 0.5 & 0 & 0 & 0 \\ 0.5 & 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{M_{xx}} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix};$$
$$\mathbf{M_{xw}} = \begin{pmatrix} -1 \\ 0 \end{pmatrix};$$
$$\mathbf{M_{xy}} = \begin{pmatrix} -1 \\ 0 \end{pmatrix};$$
$\mathbf{M_{wx}} = \begin{pmatrix} 0.5 & 0 \end{pmatrix}$;
$\mathbf{M_{ww}} = \begin{pmatrix} 0 \end{pmatrix}$;
$\mathbf{M_{wy}} = \begin{pmatrix} 0 \end{pmatrix}$;
$\mathbf{M_{yx}} = \begin{pmatrix} 0.5 & 0 \end{pmatrix}$;
$\mathbf{M_{yw}} = \begin{pmatrix} 0 \end{pmatrix}$;
$\mathbf{M_{yy}} = \begin{pmatrix} 0 \end{pmatrix}$;

$$\mathbf{J} = \begin{pmatrix} 0 & -1.0 & -0.75 & -0.75 \\ 1.0 & 0 & 0 & 0 \\ 0.75 & 0 & 0 & 0 \\ 0.75 & 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{J_{xx}} = \begin{pmatrix} 0 & -1.0 \\ 1.0 & 0 \end{pmatrix};$$
$$\mathbf{J_{xw}} = \begin{pmatrix} -0.75 \\ 0 \end{pmatrix};$$
$$\mathbf{J_{xy}} = \begin{pmatrix} -0.75 \\ 0 \end{pmatrix};$$
$$\mathbf{J_{ww}} = \begin{pmatrix} 0 \end{pmatrix};$$
$$\mathbf{J_{wy}} = \begin{pmatrix} 0 \end{pmatrix};$$
$$\mathbf{J_{yy}} = \begin{pmatrix} 0 \end{pmatrix};$$
$$\mathbf{R} = \begin{pmatrix} 0 & 0 & 0.25 & 0.25 \\ 0 & 0 & 0 & 0 \\ 0.25 & 0 & 0 & 0 \\ 0.25 & 0 & 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{xx}} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix};$$
$$\mathbf{R_{xw}} = \begin{pmatrix} 0.25 \\ 0 \end{pmatrix};$$
$$\mathbf{R_{xy}} = \begin{pmatrix} 0.25 \\ 0 \end{pmatrix};$$
$$\mathbf{R_{ww}} = \begin{pmatrix} 0 \end{pmatrix};$$
$$\mathbf{R_{wy}} = \begin{pmatrix} 0 \end{pmatrix};$$
$$\mathbf{R_{yy}} = \begin{pmatrix} 0 \end{pmatrix};$$