Structure of the port-Hamiltonian system
`rlc`

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 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 $\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$;
Dissipation variable $\mathbf{w} = \begin{pmatrix} w_1 \end{pmatrix}$;
Input $\mathbf{u} = \begin{pmatrix} u \end{pmatrix}$;
Output $\mathbf{y} = \begin{pmatrix} y \end{pmatrix}$;

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*https://github.com/A-Falaize/pyphs
†http://s3.ircam.fr

3 Constitutive relations

Hamiltonian $\mathtt{H}(\mathbf{x}) = \frac{x_2^2}{2 \cdot \mathrm{p2}} + \frac{x_1^2}{2 \cdot \mathrm{p1}}$;
Hamiltonian gradient $\nabla\mathtt{H}(\mathbf{x}) = \begin{pmatrix} \frac{x_1}{\mathrm{p1}} \\ \frac{x_2}{\mathrm{p2}} \end{pmatrix}$;
Dissipation function $\mathbf{z}(\mathbf{w}) = \begin{pmatrix} \mathrm{r} \cdot w_1 \end{pmatrix}$;
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)
p2 :	2e-06
p1 :	0.05
r :	1000.0

5 System structure

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

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