# Structure of pHs DLC

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## 1 System netlist

| line | label | dictionary.component | nodes | parameters |
|---|---|---|---|---|
| $\ell_1$ | IN | electronics.source | ('A', 'ref') | { type voltage |
| $\ell_2$ | D | electronics.diodepn | ('A', 'B') | { v0 ('v0', 0.025)<br>Is ('Is', 1e-09) |
| $\ell_3$ | C | electronics.capacitor | ('B', 'ref') | { C ('C', 2e-10) |

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

## 2 System variables

State variable $\mathbf{x} = \left( \begin{array}{c} x_{\rm C} \end{array} \right)$;
Dissipation variable $\mathbf{w} = \left( \begin{array}{c} w_{\rm D} \end{array} \right)$;
Input $\mathbf{u} = \left( \begin{array}{c} u_{\rm IN} \end{array} \right)$;

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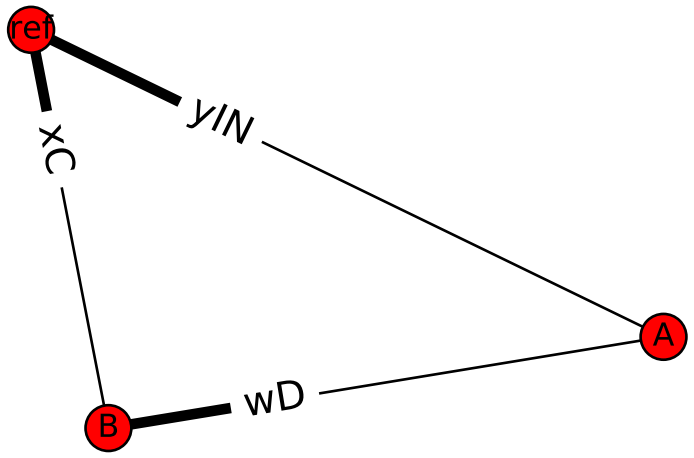


Figure 1: Graph of system `DLC`.

Output $\mathbf{y} = \left( \begin{array}{c} y_{\mathrm{IN}} \end{array} \right)$;

## 3 Constitutive relations

Hamiltonian $\mathtt{H}(\mathbf{x}) = \frac{0.5}{\mathrm{C}} \cdot x_{\mathrm{C}}^2$;
Hamiltonian gradient $\nabla \mathtt{H}(\mathbf{x}) = \left( \begin{array}{c} \frac{1.0}{\mathrm{C}} \cdot x_{\mathrm{C}} \end{array} \right)$;
Dissipation function $\mathbf{z}(\mathbf{w}) = \left( \begin{array}{c} \mathrm{Is} \cdot \left( e^{\frac{w_{\mathrm{D}}}{\mathrm{v0}}} - 1 \right) \end{array} \right)$;
Jacobian of dissipation function $\mathcal{J}_{\mathbf{z}}(\mathbf{w}) = \left( \begin{array}{c} \frac{\mathrm{Is}}{\mathrm{v0}} \cdot e^{\frac{w_{\mathrm{D}}}{\mathrm{v0}}} \end{array} \right)$;

# 4 System parameters

## 4.1 Constant

| parameter | value (SI) |
|---|---|
| v0 : | 0.025 |
| Is : | 1e-09 |
| C : | 2e-10 |

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