

1 Variables

2 root

	var	symbol	documentation	type	units	eqs
10	$F_{N,A}$	F	fundamental incidence matrix	network		
5	t	t	time	frame	s	
6	t^o	to	time zero	frame	s	4
7	t^e	te	time end	frame	s	5
8	Δt	dt_pulse	pulse length	frame	s	6
9	$pulse$	pulse	pulse function	frame		7
1	$\#$	value	numerical value	constant		
2	1	one	numerical value one	constant		1
3	0	zero	numerical value zero	constant		2
4	0.5	onehalf	numerical value one half	constant		3

3 physical

	var	symbol	documentation	type	units	eqs
11	r_{xN}	r_x	x-coordinate	frame	m	
12	r_{yN}	r_y	y-coordinate	frame	m	
13	r_{zN}	r_z	z-coordinate	frame	m	
14	U_N	U	fundamental state - internal energy	state	$kg\,m^2\,s^{-2}$	
15	S_N	S	fundamental state - entropy	state	$kg\,m^2\,K^{-1}\,s^{-2}$	
16	$n_{N,S}$	n	fundamental state - molar mass	state	mol	
17	V_N	V	fundamental state - volume	state	m^3	8
21	H_N	H	Enthalpy	state	$kg\,m^2\,s^{-2}$	12
22	A_N	A	Helmholtz energy	state	$kg\,m^2\,s^{-2}$	13
23	G_N	G	Gibbs free energy	state	$kg\,m^2\,s^{-2}$	14
24	C_N	C	fundamental state – charge	state	$A\,s$	
25	B_N	BoltzCnst	Boltzmann constant	constant	$kg\,m^2\,K^{-1}\,s^{-2}$	15
26	A^v	Avogadro	Avogadro number	constant	mol^{-1}	
27	R_N	GasConstant	gas constant	constant	$kg\,m^2\,mol^{-1}\,K^{-1}\,s^{-2}$	16
18	T_N	T	temperature	effort	K	9
19	p_N	p	pressure	effort	$kg\,m^{-1}\,s^{-2}$	10
20	$\mu_{N,S}$	chemPot	chemical potential	effort	$kg\,m^2\,mol^{-1}\,s^{-2}$	11

4 control

	var	symbol	documentation	type	units	eqs
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5 reactions

	var	symbol	documentation	type	units	eqs
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6 material

	var	symbol	documentation	type	units	eqs
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7 macroscopic

	var	symbol	documentation	type	units	eqs
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8 solid

	var	symbol	documentation	type	units	eqs
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9 fluid

	var	symbol	documentation	type	units	eqs
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10 energy

	var	symbol	documentation	type	units	eqs
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11 liquid

	var	symbol	documentation	type	units	eqs
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12 gas

	var	symbol	documentation	type	units	eqs
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13 control-control

	var	symbol	documentation	type	units	eqs
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14 energy–gas

	var	symbol	documentation	type	units	eqs
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15 energy–energy

	var	symbol	documentation	type	units	eqs
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16 gas–gas

	var	symbol	documentation	type	units	eqs
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17 energy-liquid

	var	symbol	documentation	type	units	eqs
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18 liquid–liquid

	var	symbol	documentation	type	units	eqs
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19 energy–solid

	var	symbol	documentation	type	units	eqs
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20 solid-solid

	var	symbol	documentation	type	units	eqs
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21 gas–liquid

	var	symbol	documentation	type	units	eqs
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22 gas-solid

	var	symbol	documentation	type	units	eqs
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23 liquid–solid

	var	symbol	documentation	type	units	eqs
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24 material–material

	var	symbol	documentation	type	units	eqs
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25 reactions-reactions

	var	symbol	documentation	type	units	eqs
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26 control-reactions

	var	symbol	documentation	type	units	eqs
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27 reactions-control

	var	symbol	documentation	type	units	eqs
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28 control-material

	var	symbol	documentation	type	units	eqs
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29 material-control

	var	symbol	documentation	type	units	eqs
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30 control-macroscopic

	var	symbol	documentation	type	units	eqs
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31 macroscopic-control

	var	symbol	documentation	type	units	eqs
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32 reactions-material

	var	symbol	documentation	type	units	eqs
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33 material-reactions

	var	symbol	documentation	type	units	eqs
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34 reactions–macroscopic

	var	symbol	documentation	type	units	eqs
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35 macroscopic-reactions

	var	symbol	documentation	type	units	eqs
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36 material-macroscopic

	var	symbol	documentation	type	units	eqs
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37 macroscopic-material

	var	symbol	documentation	type	units	eqs
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38 Equations

39 Generic

no	equation	documentation	layer
1	$1 := \text{Instantiate}(\text{value}, \text{value})$	numerical value one	root
2	$0 := \text{Instantiate}(\text{value}, \text{value})$	numerical value zero	root
3	$0.5 := \text{Instantiate}(\text{value}, \text{value})$	numerical value one half	root
4	$t^o := \text{Instantiate}(t, \text{value})$	time zero	root
5	$t^e := \text{Instantiate}(t, \text{value})$	time end	root
6	$\Delta t := \text{Instantiate}(t, \text{value})$	pulse length	root
7	$\text{pulse} := \text{sign}(t - t_o) - \text{sign}(t - (t_o - dt_p \text{pulse}))$	pulse function	root
8	$V_N := r_{xN} \cdot r_{yN} \cdot r_{zN}$	fundamental state - volume	physical
9	$T_N := \frac{\partial U_N}{\partial S_N}$	temperature	physical
10	$p_N := \frac{\partial U_N}{\partial V_N}$	pressure	physical
11	$\mu_{N,S} := \frac{\partial U_N}{\partial n_{N,S}}$	chemical potential	physical
12	$H_N := U_N - p_N \cdot V_N$	Enthalpy	physical
13	$A_N := U_N - T_N \cdot S_N$	Helmholtz energy	physical
14	$G_N := U_N + p_N \cdot V_N - T_N \cdot S_N$	Gibbs free energy	physical
15	$B_N := \text{Instantiate}(S_N, \#)$	Boltzmann constant	physical

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no	equation	documentation	layer
16	$R_N := Avogadro . B_N$	gas constant	physical