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	$A\,s$	
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

5 reactions

	var	symbol	documentation	type	units	eqs

6 material

	var	symbol	documentation	type	units	eqs

7 macroscopic

	var	symbol	documentation	type	units	eqs

8   solid

	var	symbol	documentation	type	units	eqs

9 fluid

	var	symbol	documentation	type	units	eqs

10 energy

	var	symbol	documentation	type	units	eqs

11 liquid

	var	symbol	documentation	type	units	eqs

12   gas

	var	symbol	documentation	type	units	eqs

13   control–control

	var	symbol	documentation	type	units	eqs

14 energy–gas

	var	symbol	documentation	type	units	eqs

15 energy–energy

	var	symbol	documentation	type	units	eqs

16 gas–gas

	var	symbol	documentation	type	units	eqs

17   energy–liquid

	var	symbol	documentation	type	units	eqs

18   liquid–liquid

	var	symbol	documentation	type	units	eqs

19   energy–solid

	var	symbol	documentation	type	units	eqs

20 solid–solid

	var	symbol	documentation	type	units	eqs

21 gas–liquid

	var	symbol	documentation	type	units	eqs

22 gas–solid

	var	symbol	documentation	type	units	eqs

23 liquid–solid

	var	symbol	documentation	type	units	eqs

24   material–material

	var	symbol	documentation	type	units	eqs

25   reactions–reactions

	var	symbol	documentation	type	units	eqs

26   control–reactions

	var	symbol	documentation	type	units	eqs

27   reactions–control

	var	symbol	documentation	type	units	eqs

28   control–material

	var	symbol	documentation	type	units	eqs

29 material–control

	var	symbol	documentation	type	units	eqs

30 control–macroscopic

	var	symbol	documentation	type	units	eqs

31 macroscopic–control

	var	symbol	documentation	type	units	eqs

32 reactions–material

	var	symbol	documentation	type	units	eqs

33   material–reactions

	var	symbol	documentation	type	units	eqs

34 reactions–macroscopic

	var	symbol	documentation	type	units	eqs

35 macroscopic–reactions

	var	symbol	documentation	type	units	eqs

36   material–macroscopic

	var	symbol	documentation	type	units	eqs

37   macroscopic–material

	var	symbol	documentation	type	units	eqs

38 Equations

39 Generic

no	equation	documentation	layer
1	$1 := \text{Instantiate}(value, value)$	numerical value one	root
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	$H_N := U_N - p_N . V_N$	Enthalpy	physical
13	$A_N := U_N - T_N . S_N$	Helmholtz energy	physical
14	$G_N := U_N + p_N . V_N - T_N . S_N$	Gibbs free energy	physical
2	$0 := \text{Instantiate}(value, value)$	numerical value zero	root
3	$0.5 := \text{Instantiate}(value, value)$	numerical value one half	root
4	$t^o := \text{Instantiate}(t, value)$	time zero	root
5	$t^e := \text{Instantiate}(t, value)$	time end	root
6	$\Delta t := \text{Instantiate}(t, value)$	pulse length	root
7	$pulse := \text{sign}\,(t - to) - \text{sign}\,(t - (to - dt_p ulse))$	pulse function	root
8	$V_N := r_{xN} . r_{yN} . r_{zN}$	fundamental state - volume	physical
9	$T_N := \frac{\partial U_N}{\partial S_N}$	temperature	physical