1 Variables

2 root

	var	symbol	documentation	type	units	eqs
8	$F_{N,A}$	F_N_A	fudamental incidence matrix	network		
5	t	t	time	frame	s	
6	t^o	to	starting time	frame	s	4
7	t^e	te	end time	frame	s	5
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
9	$P_{N,A}$	P_N_A	projection from node to arc for arc properties	projection		
10	r_{xN}	r_x	x-coordinate	frame	m	
11	r_{yN}	r_y	y-coordinate	frame	m	
12	r_{zN}	r_z	z coordinate	frame	m	
13	U_N	U	fundamental state – internal energy	state	$kg\,m^2\,s^{-2}$	
14	S_N	S	fundamental state – entropy	state	$kg\,m^2\,K^{-1}\,s^{-2}$	
15	V_N	V	fundamental state – volume	state	m^3	
16	n_{NS}	n	fundamental state – molar mass	state	mol	
20	H_N	H	enthalpy	state	$kg\,m^2\,s^{-2}$	9
21	A_N	A	Helmholtz energy	state	$kg\,m^2\,s^{-2}$	10
22	G_N	G	Gibbs free energy	state	$kg\,m^2\,s^{-2}$	11
23	C_N	charge	fundamental state – charge	state	$A\,s$	
24	A^v	Avogadro	Avogadro number	constant	mol^{-1}	
25	$k^B{}_N$	Boltzmann	Boltzmann constant	constant	$kg\,m^2\,K^{-1}\,s^{-2}$	12
26	R_N	GasConstant	gas constant	constant	$kg\,m^2\,mol^{-1}\,K^{-1}\,s^{-2}$	13
17	p_N	p	thermodynamic pressure	effort	$kg\,m^{-1}\,s^{-2}$	6
18	T_N	T	temperature	effort	K	7
19	μ_{NS}	chemPot	chemical potential	effort	$kg\,m^2\,mol^{-1}\,s^{-2}$	8

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 liquid

	var	symbol	documentation	type	units	eqs

11   gas

	var	symbol	documentation	type	units	eqs

12   control–control

	var	symbol	documentation	type	units	eqs

13   gas–liquid

	var	symbol	documentation	type	units	eqs

14   gas–gas

	var	symbol	documentation	type	units	eqs

15   liquid–liquid

	var	symbol	documentation	type	units	eqs

16   gas–solid

	var	symbol	documentation	type	units	eqs

17   solid–solid

	var	symbol	documentation	type	units	eqs

18   liquid–solid

	var	symbol	documentation	type	units	eqs

19   material–material

	var	symbol	documentation	type	units	eqs

20   reactions–reactions

	var	symbol	documentation	type	units	eqs

21   control–reactions

	var	symbol	documentation	type	units	eqs

22   reactions–control

	var	symbol	documentation	type	units	eqs

23 control–material

	var	symbol	documentation	type	units	eqs

24   material–control

	var	symbol	documentation	type	units	eqs

25   control–macroscopic

	var	symbol	documentation	type	units	eqs

26   macroscopic–control

	var	symbol	documentation	type	units	eqs

27   reactions–material

	var	symbol	documentation	type	units	eqs

28   material–reactions

	var	symbol	documentation	type	units	eqs

29   reactions–macroscopic

	var	symbol	documentation	type	units	eqs

30   macroscopic–reactions

	var	symbol	documentation	type	units	eqs

31 material–macroscopic

	var	symbol	documentation	type	units	eqs

32 macroscopic–material

	var	symbol	documentation	type	units	eqs

33   Equations

34   Generic

no	equation	documentation	layer
1	$1 := \text{Instantiate}(\#, \#)$	numerical value 1	root
2	$0 := \text{Instantiate}(\#, \#)$	numerical value zero	root
3	$0.5 := \text{Instantiate}(\#, \#)$	numerical value one half	root
4	$t^o := \text{Instantiate}(t, \#)$	starting time	root
5	$t^e := \text{Instantiate}(t, \#)$	end time	root
6	$p_N := \left(-\frac{\partial U_N}{\partial V_N} \right)$	thermodynamic pressure	physical
7	$T_N := \frac{\partial U_N}{\partial S_N}$	temperature	physical
8	$\mu_{NS} := \frac{\partial U_N}{\partial n_{NS}}$	chemical potential	physical
9	$H_N := U_N - p_N \,.\, V_N$	enthalpy	physical
10	$A_N := U_N - T_N \,.\, S_N$	Helmholtz energy	physical
11	$G_N := U_N + p_N \,.\, V_N - T_N \,.\, S_N$	Gibbs free energy	physical
12	$k^B{}_N := \text{Instantiate}(S_N, \#)$	Boltzmann constant	physical
13	$R_N := A^v \,.\, k^B{}_N$	gas constant	physical