1 Variables

2 root

		var	symbol	documentation	type	units	tokens	eqs
5		F	F	incidence matrix of a directed graph	network		[]	
6		t	t	time	frame	s	[]	
7		to	to	starting time	frame	s	[]	4
8	5	te	te	end time	frame	s	[]	5
1		$value$	value	numerical value	constant		[]	
2		$zero$	zero	numerical value zero	constant		[]	1
3	2	one	one	numerical value one	constant		[]	2
4	3	$onehalf$	onehalf	numerical value one half	constant		[]	3

3   physical

	var	symbol	documentation	type	units	tokens	eqs
9	r_{xN}	r_x	x-coordinate	frame	m	[]	
10	r_{yN}	r_y	y-coordinate	frame	m	[]	
23	r_{zN}	r_z	z-coordinate	frame	m	[]	
11	U_N	U	foundation state – internal energy	state	$kg\,m^2\,s^{-2}$	[]	
12	S_N	S	foundation state – entropy	state	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	
13	V_N	V	foundation state – volume	state	m^3	[]	
18	H_N	H	enthalpy	state	$kg\,m^2\,s^{-2}$	[]	9
19	A_N	A	Helmholtz energy	state	$kg\,m^2\,s^{-2}$	[]	10
20	G_N	G	Gibbs energy	state	$kg\,m^2\,s^{-2}$	[]	11
42	n_{NS}	n	species molar mass	state	mol	[]	
26	$Avogadro$	Avogadro	Avogadro number	constant	mol^{-1}	[]	
27	$Boltzmann_N$	Boltzmann	Boltzmann constant	constant	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	16
28	$GasConstant_N$	GasConstant	Gas constant	constant	$kg\,m^2\,mol^{-1}\,K^{-1}\,s^{-2}$	[]	17
15	p_N	p	thermodynamic pressure	effort	$kg\,m^{-1}\,s^{-2}$	[]	6
16	T_N	T	temperature	effort	K	[]	7
45	$chem_pot_{NS}$	chem_pot	chemical potential	effort	$kg\,m^2\,mol^{-1}\,s^{-2}$	[]	32
21	v_{xN}	v_x	velocity in x-direction	seconaryState	ms^{-1}	[]	12
22	v_{yN}	v_y	velocity in y direction	seconaryState	ms^{-1}	[]	13
24	v_{zN}	v_z	velocity in z-direction	seconaryState	ms^{-1}	[]	14
25	v_N	v	velocity vector	seconaryState	ms^{-1}	[]	15

4   control

	var	symbol	documentation	type	units	tokens	eqs

5 reactions

	var	symbol	documentation	type	units	tokens	eqs

6   material

	var	symbol	documentation	type	units	tokens	eqs
29	Mm_S	Mm	species molecular masses	constant	$kg\,mol^{-1}$	[]	
30	Cp_N	Cp	total heat capacity at constant pressure	constant	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	18
31	Cv_N	Cv	total heat capacity at constant volume	constant	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	19
34	kq_{xN}	kq_x	thermal conductivity in x-direction	constant	$kg\,K^{-1}\,s^{-3}$	[]	22
35	kq_{yN}	kq_y	thermal conductivity in y-direction	constant	$kg\,K^{-1}\,s^{-3}$	[]	23
36	kq_{zN}	kq_z	thermal conductivity in z-direction	constant	$kg\,K^{-1}\,s^{-3}$	[]	24
37	kq_N	kq	Carthesian thermal conductivity vector	constant	$kg\,K^{-1}\,s^{-3}$	[]	25
46	C_{pN}	C_p	total heat capacity at constant pressure	seconaryState	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	33
47	C_{vN}	C_v	specific heat capacity at constant volume	seconaryState	$kg\,m^2\,K^{-1}\,s^{-2}$	[]	34
48	cp_S	cp	specific heat capacity at constant pressure	seconaryState	$m^2\,mol^2\,K^{-1}\,s^{-2}$	[]	35
49	cv_S	cv	specific heat capacity at constant volume	seconaryState	$m^2\,mol^2\,K^{-1}\,s^{-2}$	[]	36

7 macroscopic

	var	symbol	documentation	type	units	tokens	eqs

8   solid

	var	symbol	documentation	type	units	tokens	eqs

9 fluid

	var	symbol	documentation	type	units	tokens	eqs

10   liquid

	var	symbol	documentation	type	units	tokens	eqs

11 gas

	var	symbol	documentation	type	units	tokens	eqs

12 control–control

	var	symbol	documentation	type	units	tokens	eqs

13   gas–liquid

	var	symbol	documentation	type	units	tokens	eqs

14   gas–gas

	var	symbol	documentation	type	units	tokens	eqs

15 liquid–liquid

	var	symbol	documentation	type	units	tokens	eqs

16   gas–solid

	var	symbol	documentation	type	units	tokens	eqs

17   solid–solid

	var	symbol	documentation	type	units	tokens	eqs

18   liquid–solid

	var	symbol	documentation	type	units	tokens	eqs

19 material–material

	var	symbol	documentation	type	units	tokens	eqs

20   reactions–reactions

	var	symbol	documentation	type	units	tokens	eqs

21 Equations

22 Generic

no	equation	documentation	layer
1	$zero := \mathrm{Instantiate}(value, value)$	numerical value zero	root
2	$one := \mathrm{Instantiate}(value, value)$	numerical value one	root
3	$onehalf := \mathrm{Instantiate}(value, value)$	numerical value one half	root
4	$to := \mathrm{Instantiate}(t, value)$	starting time	root
5	$te := \mathrm{Instantiate}(t, value)$	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
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 energy	physical
12	$v_{xN} := \frac{\partial r_{xN}}{\partial t}$	velocity in x-direction	physical
13	$v_{yN} := \frac{\partial r_{yN}}{\partial t}$	velocity in y direction	physical
14	$v_{zN} := \frac{\partial r_{zN}}{\partial t}$	velocity in z-direction	physical
15	$v_N := \mathrm{Stack}\,(v_{xN}, v_{yN}, v_{zN})$	velocity vector	physical
16	$Boltzmann_N := \mathrm{Instantiate}(S_N, value)$	Boltzmann constant	physical
17	$GasConstant_N := Avogadro \, . \, Boltzmann_N$	Gas constant	physical

no	equation	documentation	layer
18	$Cp_N := \frac{\partial H_N}{\partial T_N}$	total heat capacity	material
19	$Cv_N := \frac{\partial U_N}{\partial T_N}$	total heat capacity at constant volume	material
22	$kq_{xN} := (V_N)^{-1} \cdot \frac{\partial U_N}{\partial T_N} \cdot v_{xN}$	thermal conductivity in x-direction	material
23	$kq_{yN} := (V_N)^{-1} \cdot \frac{\partial U_N}{\partial T_N} \cdot v_{yN}$	thermal conductivity in y-direction	material
24	$kq_{zN} := (V_N)^{-1} \cdot \frac{\partial U_N}{\partial T_N} \cdot v_{zN}$	thermal conductivity in z-direction	material
25	$kq_N := \text{Stack}\,(kq_{xN}, kq_{yN}, kq_{zN})$	Carthesian thermal conductivity vector	material
32	$chem_pot_{NS} := \frac{\partial U_N}{\partial n_{NS}}$	chemical potential	physical
33	$C_{pN} := \frac{\partial H_N}{\partial T_N}$	total heat capacity at constant pressure	material
34	$C_{vN} := \frac{\partial U_N}{\partial T_N}$	specic heat capacity at constant volume	material
35	$cp_S := Cp_N \cdot (Mm_S)^{-1} \overset{N \in NS}{\underset{\star}{}} n_{NS}$	specific heat capacity at constant pressure	material
36	$cv_S := Cv_N \cdot (Mm_S)^{-1} \overset{N \in NS}{\underset{\star}{}} n_{NS}$	specific heat capacity at constant volume	material