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	te	`te`	end time	frame	s	[]	5
1	$value$	`value`	numerical value	constant		[]	
2	$zero$	`zero`	numerical value zero	constant		[]	1
3	one	`one`	numerical value one	constant		[]	2
4	$onehalf$	`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	[]	
14	n_N	n	foundation state – species mass	state	mol	[]	
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
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
17	$chem_pot_N$	chem_pot	chemical potential	effort	$kg\,m^2\,mol^{-1}\,s^{-2}$	[]	8
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	$MolecularMass_S$	`MolecularMass`	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
32	cp_S	`cp`	specific heat capacity at constant pressure	constant	$m^2\,mol^2\,K^{-1}\,s^{-2}$	[]	20
33	cv_S	`cv`	speciic heat capacity at constant volume	constant	$m^2\,mol^2\,K^{-1}\,s^{-2}$	[]	21
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

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	$zero := \text{Instantiate}(value, value)$	numerical value zero	root
2	$one := \text{Instantiate}(value, value)$	numerical value one	root
3	$onehalf := \text{Instantiate}(value, value)$	numerical value one half	root
4	$to := \text{Instantiate}(t, value)$	starting time	root
5	$te := \text{Instantiate}(t, value)$	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
8	$chem_pot_N := \frac{\partial U_N}{\partial n_N}$	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 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	$v_N := \text{Stack}\,(v_{xN}, v_{yN}, v_{zN})$	velocity vector	physical
16	$Boltzmann_N := \text{Instantiate}(S_N, value)$	Boltzmann constant	physical

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no	equation	documentation	layer
17	$GasConstant_N := Avogadro \,.\, Boltzmann_N$	Gas constant	physical
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
20	$cp_S := Cp_N \,.\, (MolecularMass_S)^{-1} \overset{N \in NS}{\star} n_N$	specific heat capacity at constant pressure	material
21	$cv_S := Cv_N \,.\, (MolecularMass_S)^{-1} \overset{N \in NS}{\star} n_N$	speciic heat capacity at constant volume	material
22	$kq_{xN} := (V_N)^{-1} \,.\, \frac{\partial U_N}{\partial T_N} \,.\, v_{xN}$	thermal conductivity in x-direction	material
23	$kq_{yN} := (V_N)^{-1} \,.\, \frac{\partial U_N}{\partial T_N} \,.\, v_{yN}$	thermal conductivity in y-direction	material
24	$kq_{zN} := (V_N)^{-1} \,.\, \frac{\partial U_N}{\partial T_N} \,.\, v_{zN}$	thermal conductivity in z-direction	material
25	$kq_N := \mathrm{Stack}\,(kq_{xN}, kq_{yN}, kq_{zN})$	Carthesian thermal conductivity vector	material