1 Variables

2 root

	var	symbol	documentation	type	units	tokens	eqs
13	$F_{N,A}$	`F`	directed graph incidence matrix	network		[]	
1	t_N	`t`	time	frame	s	[]	
3	${t^o}_N$	`to`	starting time	frame	s	[]	1
4	${t^e}_N$	`te`	end time	frame	s	[]	2
2	#	`value`	numerical value	constant		[]	
18	0	`null`	numerical value 0	constant		[]	16
19	1	`one`	numerical value 1	constant		[]	17

3 System

	var	symbol	documentation	type	units	tokens	eqs
14	${\hat{x}^a}_N$	`fx_a`	flow of x mechanism a	transport	ms^{-1}	[]	9 20
15	${\hat{x}^b}_N$	`fx_b`	flow of x mechanism b	transport	ms^{-1}	[]	10 21
5	x_N	`x`	state - length	state	m	[]	13
11	${\pi^a}_N$	`pi_a`	effort a	state	m	[]	7 14
12	${\pi^b}_N$	`pi_b`	effort b	state	m	[]	8 15
16	$\dot{x}_N$	`dx`	differential state	state	ms^{-1}	[]	11 18
17	${x^o}_N$	`xo`	initial condition	state	m	[]	12
20	ϖ_N	`pi_stack`	the stack of intensive variables	state	m	[]	19
7	K_N	`K`	frequency a	constant	s^{-1}	[]	3
8	L_N	`L`	frequency b	constant	s^{-1}	[]	4

Continued on next page

	var	symbol	documentation	type	units	tokens	eqs
9	M	`M`	gain a	constant		[]	5
10	N	`N`	gain b	constant		[]	6

4 Properties

	var	symbol	documentation	type	units	tokens	eqs

5 Control

	var	symbol	documentation	type	units	tokens	eqs

6 System–Properties

	var	symbol	documentation	type	units	tokens	eqs

7 Properties–System

	var	symbol	documentation	type	units	tokens	eqs

8 System–Control

	var	symbol	documentation	type	units	tokens	eqs

9 Control–System

	var	symbol	documentation	type	units	tokens	eqs

10 Properties–Control

	var	symbol	documentation	type	units	tokens	eqs

11 Control–Properties

	var	symbol	documentation	type	units	tokens	eqs

12 Equations

12.1 Model equations

no	equation	documentation	layer
1	$t^o{}_N := Set(t_N, \#)$	starting time	root
2	$t^e{}_N := Set(t_N, \#)$	end time	root
3	$K_N := Set((t_N)^{-1}, \#)$	frequency a	System
4	$L_N := Set((t_N)^{-1}, \#)$	frequency b	System
5	$M := Set(\#, \#)$	gain a	System
6	$N := Set(\#, \#)$	gain b	System
7	$\pi^a{}_N := M \,.\, x_N$	effort a	System
8	$\pi^b{}_N := N \,.\, x_N$	effort b	System
9	$\hat{x}^a{}_N := F_{N,A} \overset{A}{\star} \left(K_N \,.\, F_{N,A} \overset{N}{\star} \pi^a{}_N \right)$	flow of x mechanism a	System
10	$\hat{x}^b{}_N := F_{N,A} \overset{A}{\star} \left(L_N \,.\, F_{N,A} \overset{N}{\star} \pi^b{}_N \right)$	flow of x mechanism b	System
11	$\dot{x}_N := \hat{x}^a{}_N + \hat{x}^b{}_N$	differential state	System
12	$x^o{}_N := Set(x_N, \#)$	initial condition	System
13	$x_N := \int_{t^o{}_N}^{t^e{}_N} \dot{x}_N \;\; d\, t_N + x^o{}_N$	state - length	System
14	$\pi^a{}_N := Set(\pi^a{}_N, \#)$	effort a	System
15	$\pi^b{}_N := Set(\pi^b{}_N, \#)$	effort b	System
16	$0 := Set(\#, \#)$	numerical value 0	root

Continued on next page

no	equation	documentation	layer
17	$1 := Set(\#, \#)$	numerical value 1	root
18	$\dot{x}_N := Set(\dot{x}_N, 0)$	differential state	System
19	$\underline{\pi}_N := Stack\left({\pi^a}_N, {\pi^b}_N\right)$	the stack of intensive variables	System
20	${\hat{x}^a}_N := Set({\hat{x}^a}_N, \#)$	flow of x mechanism a	System
21	${\hat{x}^b}_N := Set({\hat{x}^b}_N, \#)$	flow of x mechanism b	System