

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_N^o | to | starting time | frame | s | [] | 1 |
| 4 | t_N^e | 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 |
|----|---------------|-----------------|----------------------------------|----------|-----------|--------|-------|
| 5 | x_N | x | state - length | state | m | [] | 13 |
| 11 | π_N^a | pi_a | effort a | state | m | [] | 7 14 |
| 12 | π_N^b | pi_b | effort b | state | m | [] | 8 15 |
| 14 | \hat{x}_N^a | fx_a | flow of x mechanism a | state | ms^{-1} | [] | 9 |
| 15 | \hat{x}_N^b | fx_b | flow of x mechanism b | state | ms^{-1} | [] | 10 |
| 16 | \dot{x}_N | dx | differential state | state | ms^{-1} | [] | 11 18 |
| 17 | x_N^o | 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 | $x_N := \int_{t^o_N}^{t^e_N} \dot{x}_N dt + x^o_N$ | 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 | $\underline{\pi}_N := Stack(\pi^a_N, \pi^b_N)$ | the stack of intensive variables | System |