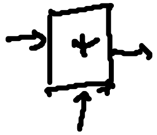
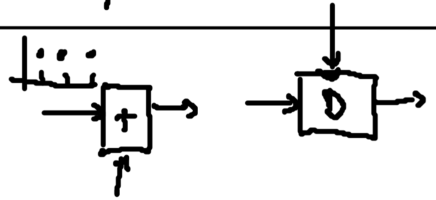
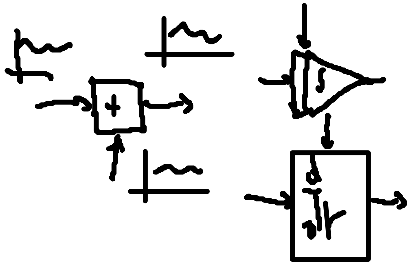
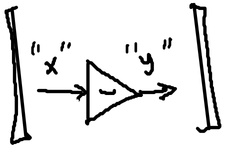
HIERARCHY

FLAT

			SEMANTICS	
TIME ↓	CBD	SYNTAX	DENOTATIONAL "WHAT"	OPERATIONAL "HOW"
{NOW}	ALGEBRAIC (ALG-CBD)	 NO LOOPS WITH LOOPS	✓ ✓	✓
ℕ	DISCRETE-TIME (DT-CBD)		✓	✓
ℝ	CONTINUOUS-TIME (CT-CBD)			

DISCRETE-TIME CBD (DT-CBD)



$:= [\![\text{"y"}]\!] = -[\![\text{"x"}]\!]$ $mvy(i) = -mvx(i), \forall i \in \mathbb{N}_\phi$

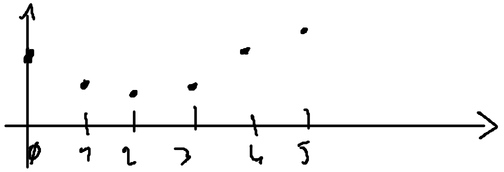
$mvx, mvy \in \mathbb{N}_\phi \to \mathbb{R}$

$- : \mathbb{R} \times \mathbb{R} \to \mathbb{R}$

x_i $i \in \mathbb{N}_\phi$

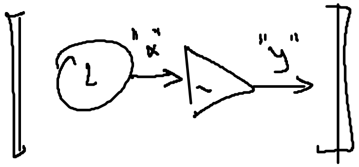
$x(i)$

mvx

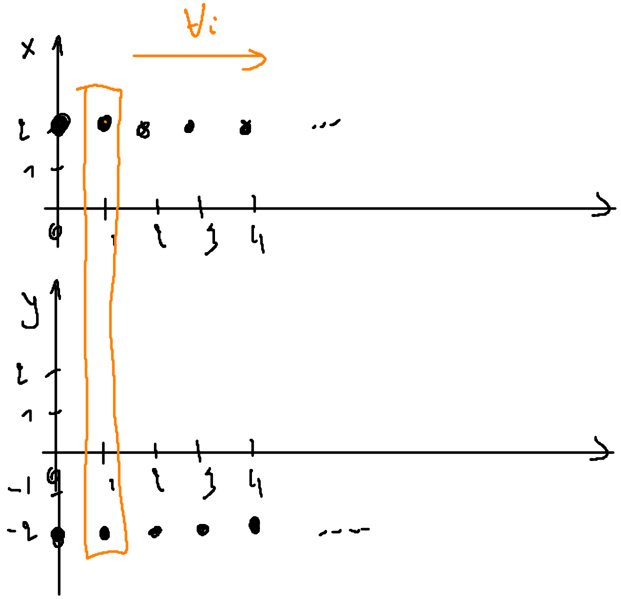


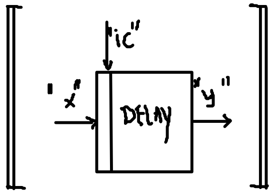
$mvx = \{\phi \to 10.3, 1 \mapsto 3.5, 2 \mapsto 3.33, \dots\}$

$[(\phi, 10.3), (1, 3.5), (2, 3.33), \dots]$



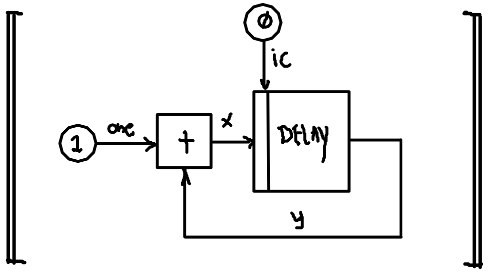
$=$
$$\begin{cases} x(i) = 2 \\ y(i) = -x(i) \end{cases} \quad \forall i \in \mathbb{N}_\phi$$





$$:= \begin{cases} Mvy(i) = Mvx(i-1), & \forall i \in \mathbb{N} \\ Mvy(\phi) = Mvic(\phi) \end{cases}$$

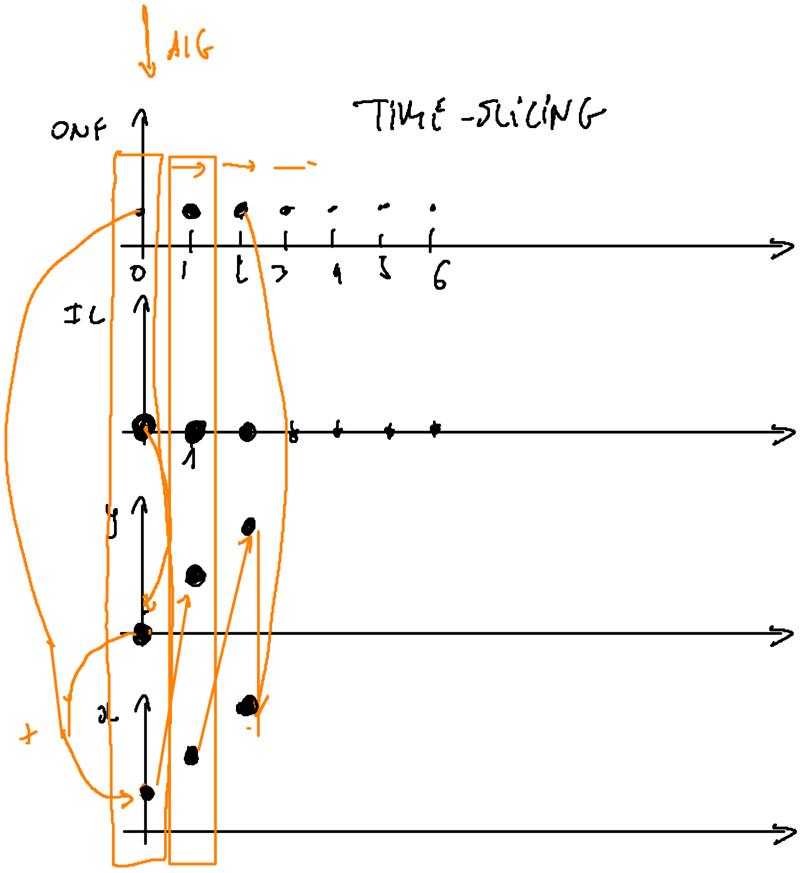
$$vIC, vy, vx, vone \in \mathbb{N}_\phi \to \mathbb{R}$$



$$:= \begin{cases} vIC(i) = \phi, \ \forall i \in \mathbb{N}_\phi \\ vy(i) = vx(i-1), \ \forall i \in \mathbb{N} \\ vy(\phi) = ic(\phi) \leftarrow \\ vx(i) = vone(i) + vy(i), \ \forall i \in \mathbb{N}_\phi \\ vone(i) = 1, \ \forall i \in \mathbb{N}_\phi \end{cases}$$

$=$ $([0, 0, 0, \ldots], [0, 1, 1, \ldots], [1, 2, 3, \ldots], [1, 1, 1, \ldots]) \in \mathbb{R}$

COUNTER

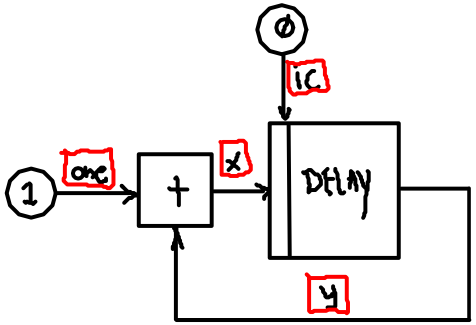


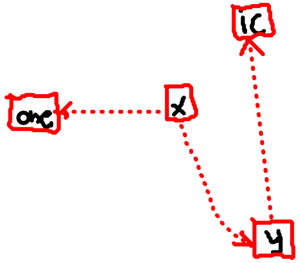
TIME-SLICING

operational semantics

```
i = 0

while (not end_condition(i, ...)):

  depGraph = buildDepGraph(CBD)
  schedule = loopDetectAndTopSort(depGraph)

  for gblock in schedule:
    gblock.compute()

  i++
```

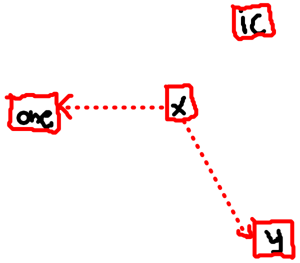
```
i = 0

if (not end_condition(i, ...)):
  depGraph = buildDepGraph(CBD)
  schedule = loopDetectAndTopSort(depGraph)

  for gblock in schedule:
    gblock.compute()
else:
  exit()

i = 1

while (not end_condition(i, ...)):

  depGraph = buildDepGraph(CBD)
  schedule = loopDetectAndTopSort(depGraph)

  for gblock in schedule:
    gblock.compute()

  i++
```





$i = \emptyset$

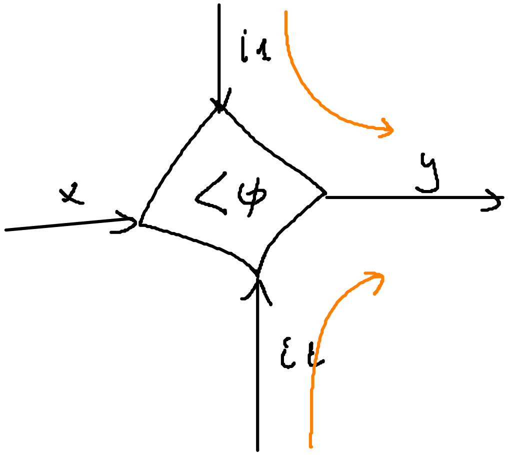
schedule = [one, IC, y, x]

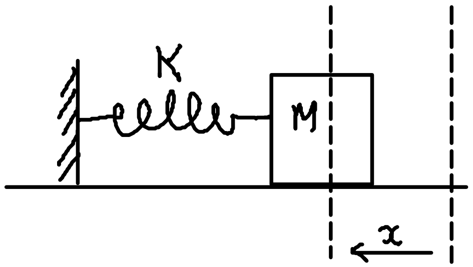


$\forall i \in \mathbb{N}$

schedule = [y, one, x, IC]

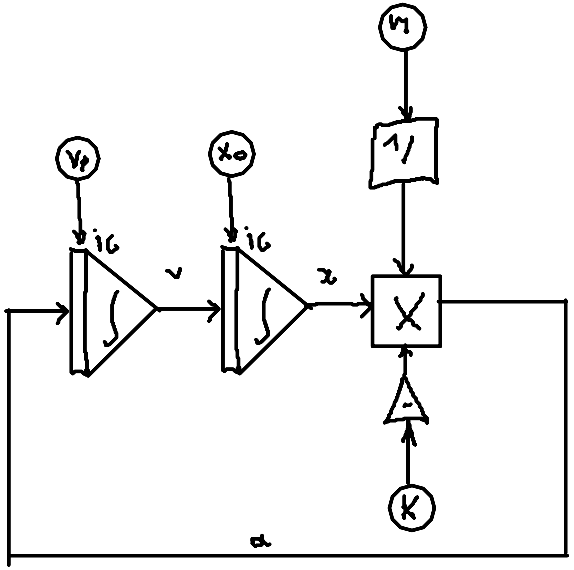
DYNAMIC STRUCTURE





$F = ma$ $\quad M \frac{d^2x}{dt^2} = -K\,x$

$$\begin{cases} \frac{dx}{dt} = v & x(0) = X_\phi \\ \frac{dv}{dt} = -\frac{k}{M}\,x & v(0) = V_\phi \end{cases}$$


M
1/
v_ϕ
x_o
ic
ic
v
x
X
-
K
α