

An Interpretation of How Simulation Software, *like LabVIEW's*[®] *Control Design & Simulation module,* might Work

(Work in Progress)

These slides and their notes are published at:

<http://twilight-pc-help.com/InterpretationOfHowSimulationSoftware,LikeLabVIEWsCDandSim,MightWork.pdf>

Just these slides are published at:

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An Interpretation of How Simulation Software might Work

An Interpretation of How Simulation Software might Work

Well,

An Interpretation of How Simulation Software might Work

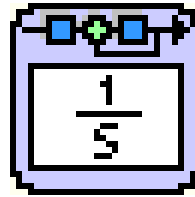
Well,

I think it boils down to...

An Interpretation of How Simulation Software might Work

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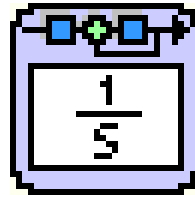


the **Integrator** block

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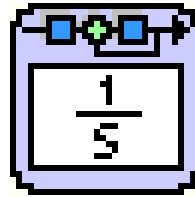
the **Integrator** block

It somehow turns parameters, like:

An Interpretation of How Simulation Software might Work

Well,

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the **Integrator** block

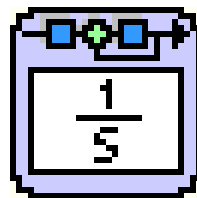
It somehow turns parameters, like:

Acceleration

An Interpretation of How Simulation Software might Work

Well,

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the **Integrator** block

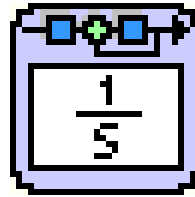
It somehow turns parameters, like:

Acceleration ...into Velocity

An Interpretation of How Simulation Software might Work

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the **Integrator** block

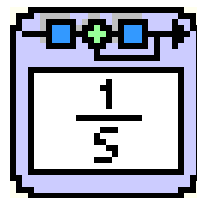
It somehow turns parameters, like:

Acceleration ...into Velocity and Velocity

An Interpretation of How Simulation Software might Work

Well,

I think it boils down to...



the **Integrator** block

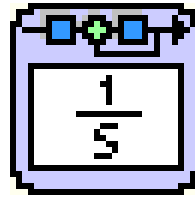
It somehow turns parameters, like:

Acceleration ...into Velocity and Velocity ...into Position

An Interpretation of How Simulation Software might Work

Well,

I think it boils down to...



the **Integrator** block

It somehow turns parameters, like:

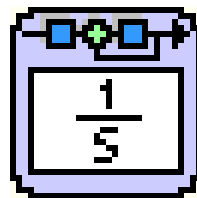
Acceleration ...into Velocity and Velocity ...into Position

Note:

An Interpretation of How Simulation Software might Work

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the **Integrator** block

It somehow turns parameters, like:

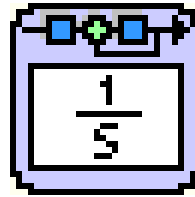
Acceleration ...into Velocity and Velocity ...into Position

Note: Acceleration is the rate-of-change of Velocity

An Interpretation of How Simulation Software might Work

Well,

I think it boils down to...



the **Integrator** block

It somehow turns parameters, like:

Acceleration ...into Velocity and Velocity ...into Position

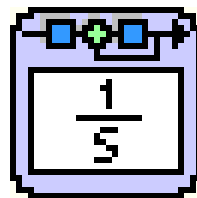
Note: Acceleration is the rate-of-change of Velocity

Also note:

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Well,

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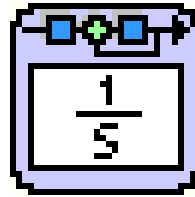
It somehow turns parameters, like:

Acceleration ...into Velocity and Velocity ...into Position

Note: Acceleration is the rate-of-change of Velocity

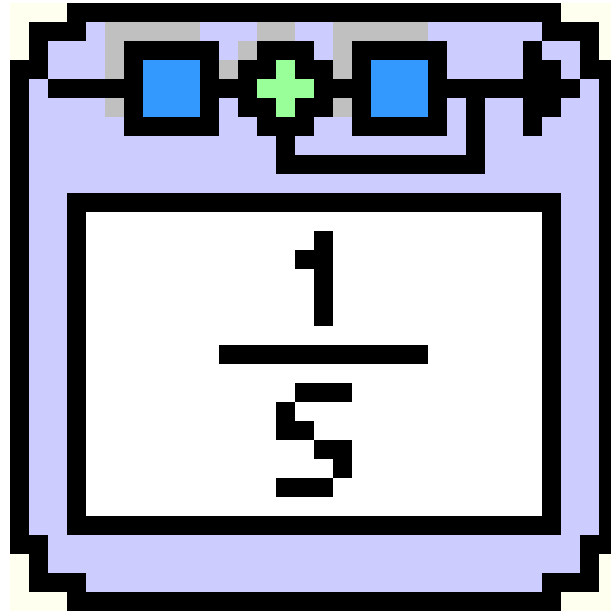
Also note: **Velocity** is the rate-of-change of Position

An Interpretation of How Simulation Software might Work



Let's take a closer look...

An Interpretation of How Simulation Software might Work

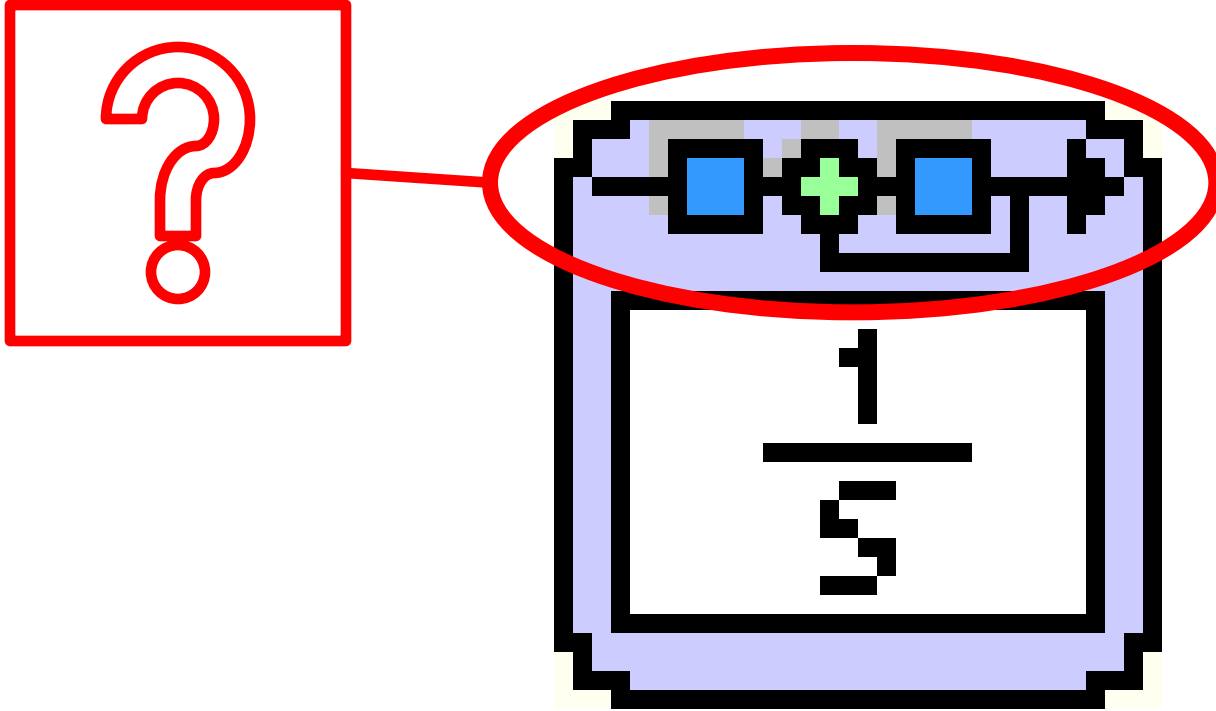


An Interpretation of How Simulation Software might Work



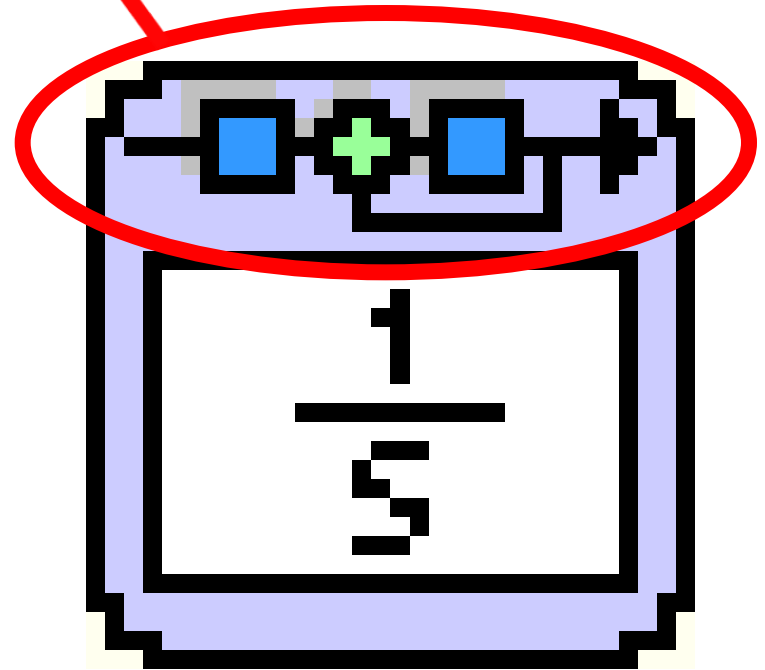
I wondered if its glyphs
offered any clues?

An Interpretation of How Simulation Software might Work

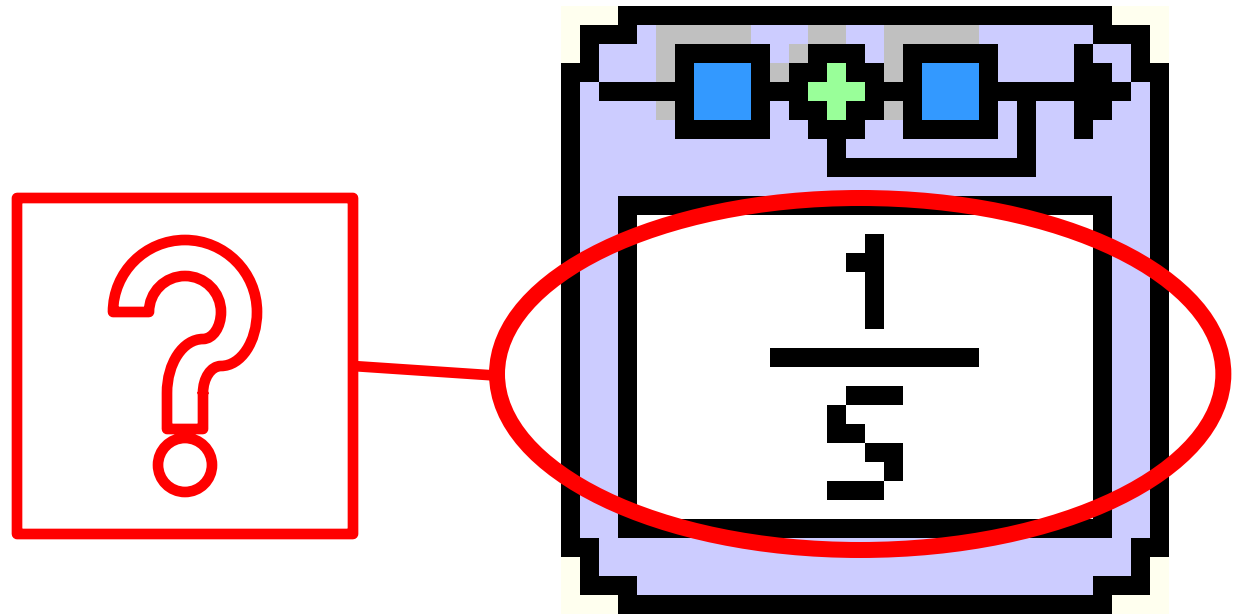


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This one just means
that it's part of
LabVIEW's
Control Design &
Simulation Library

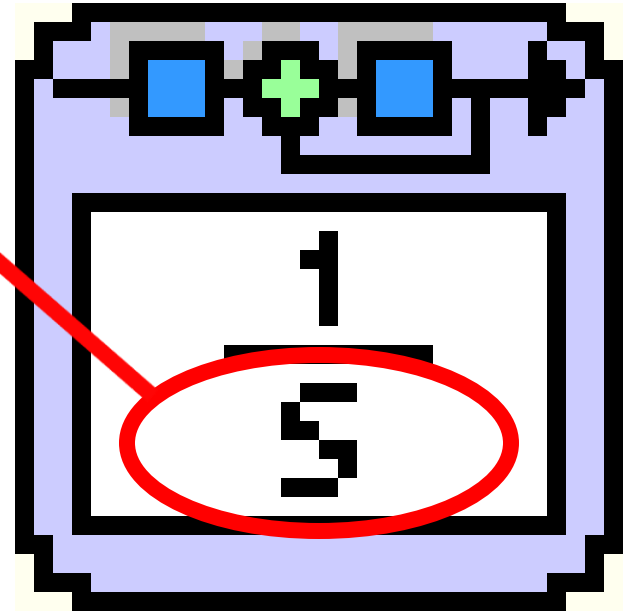


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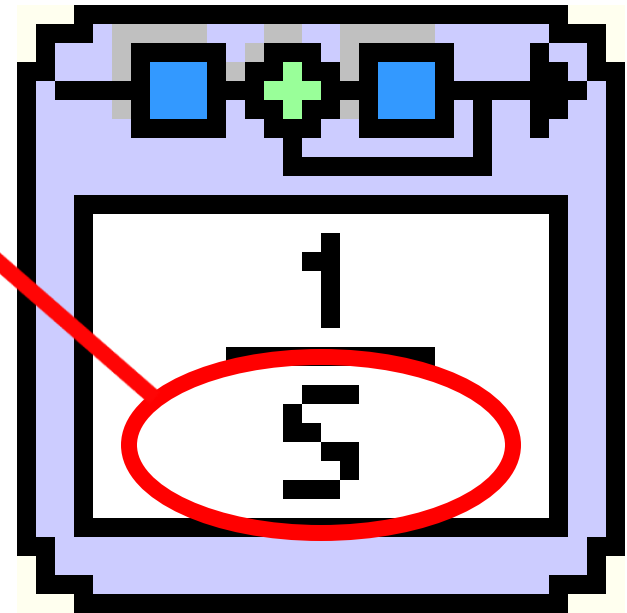
**'Coined' by
Pierre-Simon Laplace**



An Interpretation of How Simulation Software might Work

**'Coined' by
Pierre-Simon Laplace**

It represents a number
that's based on
frequency, instead of
time.

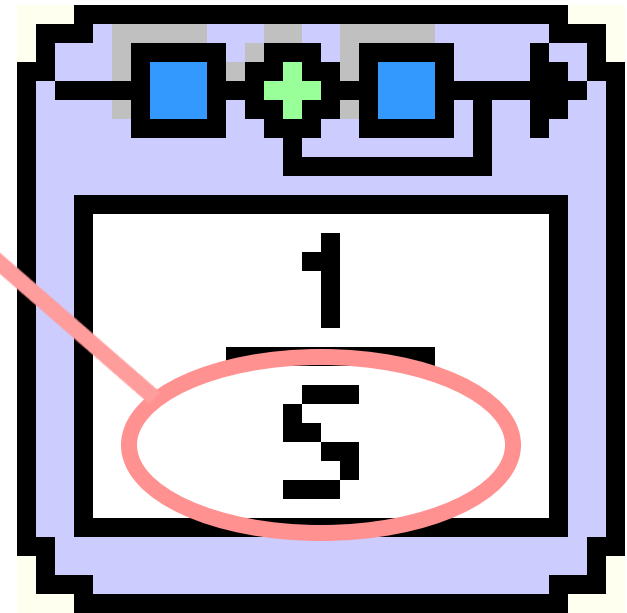


An Interpretation of How Simulation Software might Work

'Coined' by
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It represents a number
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When an equation is converted
from being based on time to
frequency, then

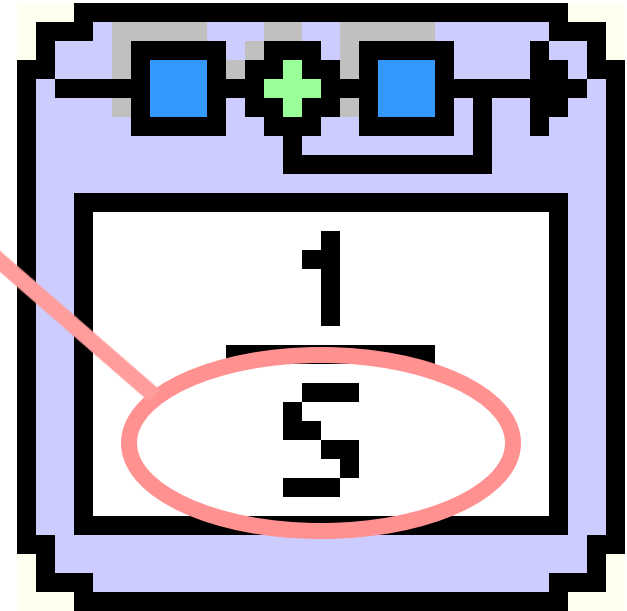


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'Coined' by
Pierre-Simon Laplace

It represents a number
that's based on
frequency, instead of
time.

When an equation is converted
from being based on time to
frequency, then
Integration
becomes Division by 's'.



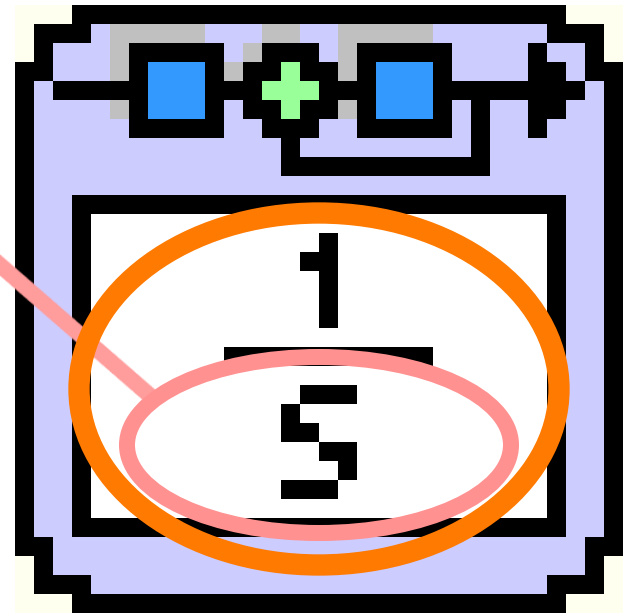
An Interpretation of How Simulation Software might Work

'Coined' by
Pierre-Simon Laplace

It represents a number
that's based on
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time.

When an equation is converted
from being based on time to
frequency, then

Integration
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**So, in a 'twisted'
sort of way,
1/s means Integrate**

I wondered...

I wondered...

is this how the

Integrator block works?

*I wondered...
is this how the
Integrator block works?*

***...does it do the
time-to-frequency
conversion thing?***

Nope!

Oh well.

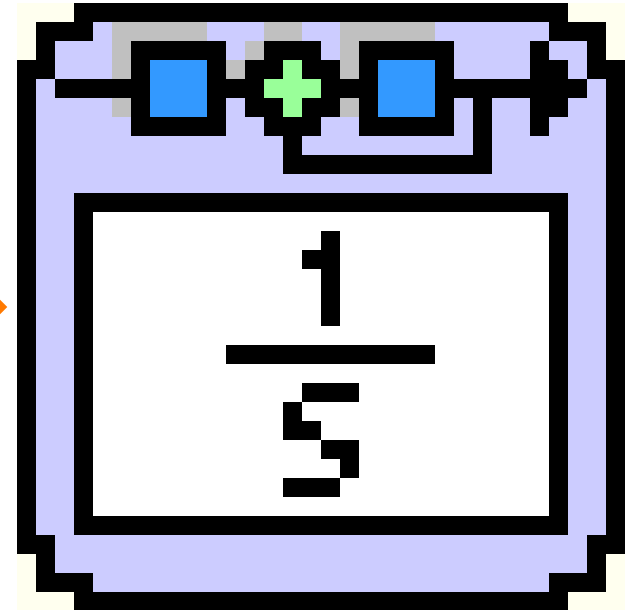
I then wondered...

I then wondered...

...what does it want?

An Interpretation of How Simulation Software might Work

What does it want?



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Well,



An Interpretation of How Simulation Software might Work

Well, it wants to know
two things...



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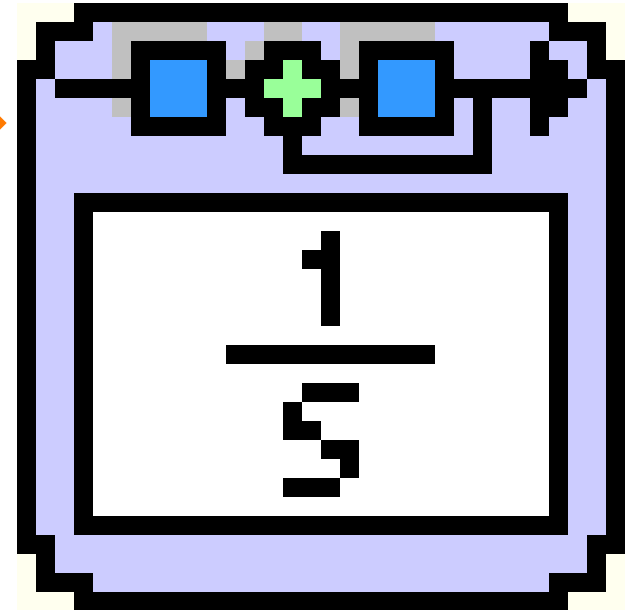
The Integrator block
wants to know...



An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be



An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be
(in **DBL** format),



An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be
(in **DBL** format), before it does
its 'Integration thing'.



An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be
(in **DBL** format), before it does
its 'Integration thing'.

And what value to integrate.

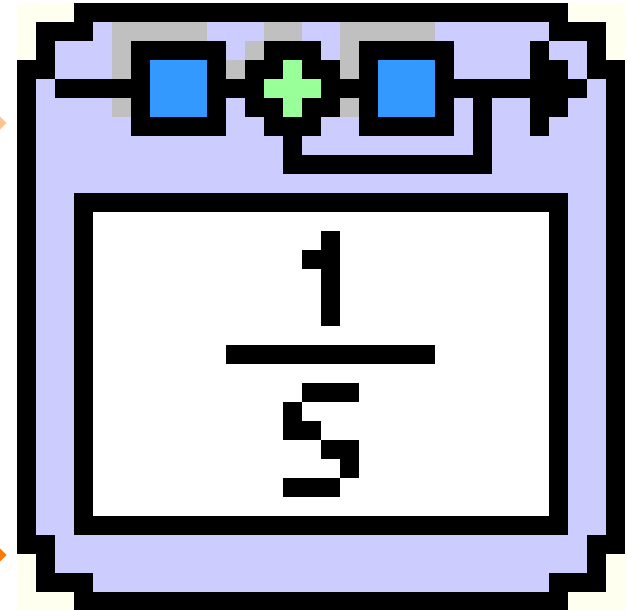


An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be
(in **DBL** format), before it does
its 'Integration thing'.

And what value to integrate.
(Also in **DBL** format)



An Interpretation of How Simulation Software might Work

The Integrator block
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What its output will be
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(Also in **DBL** format)

What the...?



An Interpretation of How Simulation Software might Work

The Integrator block
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What its output will be
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(Also in **DBL** format)

What the...? Why is it asking me
for the output? Isn't that what
it's suppose to figure-out?



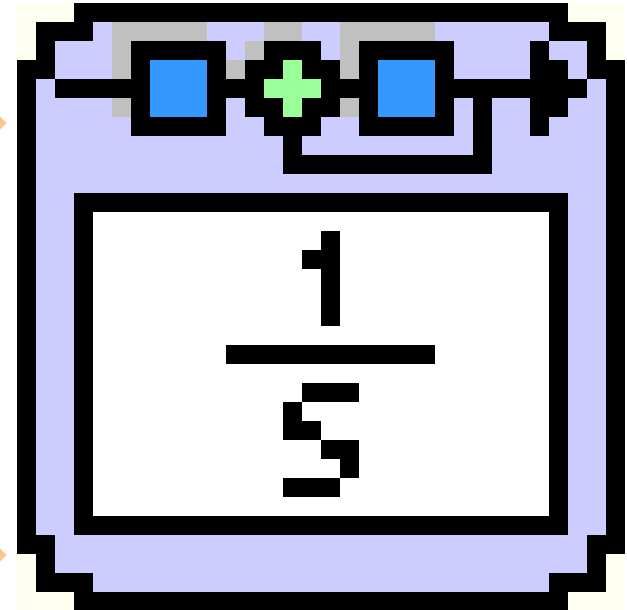
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Here's the catch...

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And what value to integrate.
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What the...? Why is it asking me
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Here's the catch... It can only
compute the output of the next
time-step,

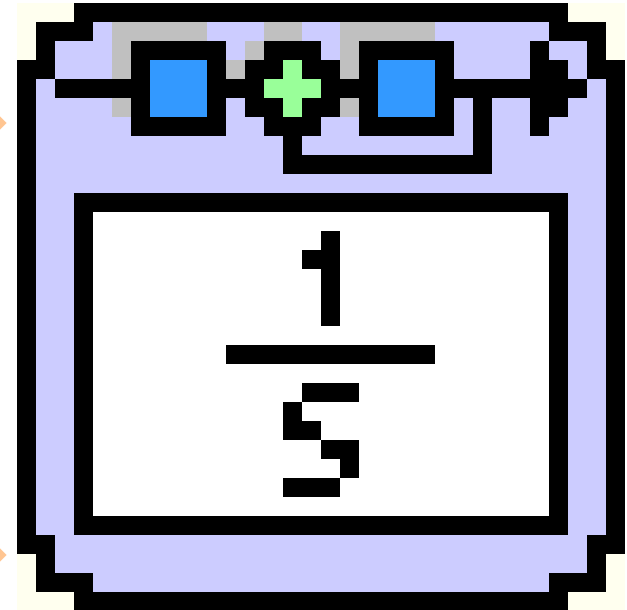
An Interpretation of How Simulation Software might Work

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(Also in **DBL** format)

What the...? Why is it asking me
for the output? Isn't that what
it's suppose to figure-out?



Here's the catch... It can only
compute the output of the next
time-step, not the present one

An Interpretation of How Simulation Software might Work

The Integrator block
wants to know...

What its output will be
(in **DBL** format), before it does
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(Also in **DBL** format)

What the...? Why is it asking me
for the output? Isn't that what
it's suppose to figure-out?



Here's the catch... It can only
compute the output of the next
time-step, not the present one
(e.g. initial time-step).

An Interpretation of How Simulation Software might Work

The Integrator block
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And what **value to integrate.**
(Also in **DBL** format)

Value...?



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Value...? Isn't it
suppose to integrate
an equation?



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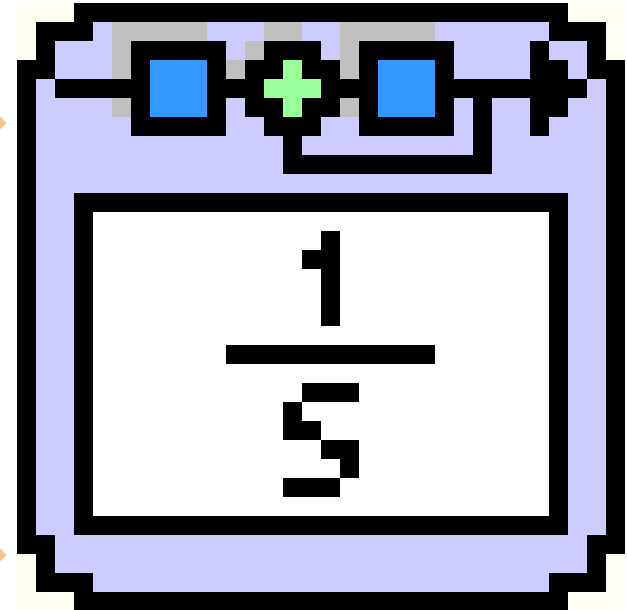
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Value...? Isn't it
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an equation?

Well...



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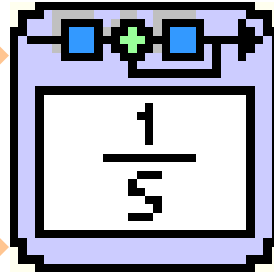


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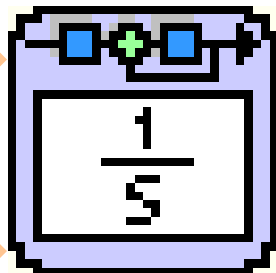
Well... Not like what is taught in a calculus class. The methods taught there,

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Value...? Isn't it suppose to integrate an equation?

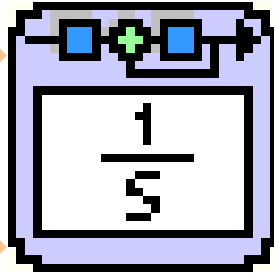
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that:

An Interpretation of How Simulation Software might Work

The Integrator block wants to know...

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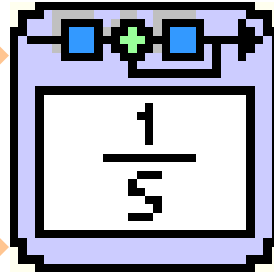
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that: consist of 1 or more 'rate-of-change derivations' of a variable...

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Value...? Isn't it suppose to integrate an equation?

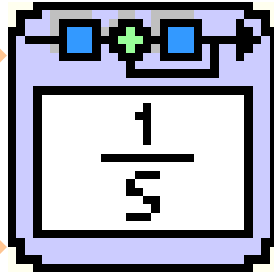
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that: consist of 1 or more 'rate-of-change derivations' of a variable... and can also simulate a real-world situation.

An Interpretation of How Simulation Software might Work

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Value...? Isn't it suppose to integrate an equation?

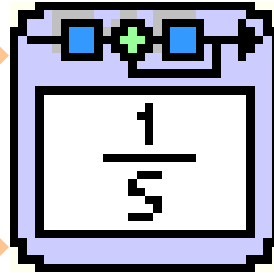
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that: consist of 1 or more 'rate-of-change derivations' of a variable... and can also simulate a real-world situation. **However,**

An Interpretation of How Simulation Software might Work

The Integrator block wants to know...

What its output will be (in **DBL** format), before it does its 'Integration thing'.

And what value to integrate. (Also in **DBL** format)



Value...? Isn't it suppose to integrate an equation?

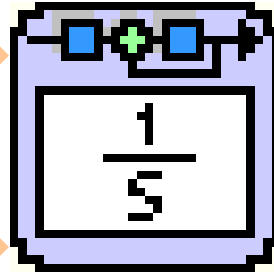
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that: consist of 1 or more 'rate-of-change derivations' of a variable... and can also simulate a real-world situation. However, if we can live with estimates, in-place of exact solutions,

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Value...? Isn't it suppose to integrate an equation?

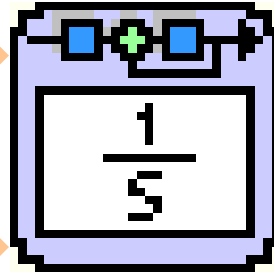
Well... Not like what is taught in a calculus class. The methods taught there, are only able to solve some of the equations that: consist of 1 or more 'rate-of-change derivations' of a variable... and can also simulate a real-world situation. However, if we can live with estimates, in-place of exact solutions, then the Integrator block can help us solve any equation that consists of 1 or more 'rate-of-change derivations' of a variable.

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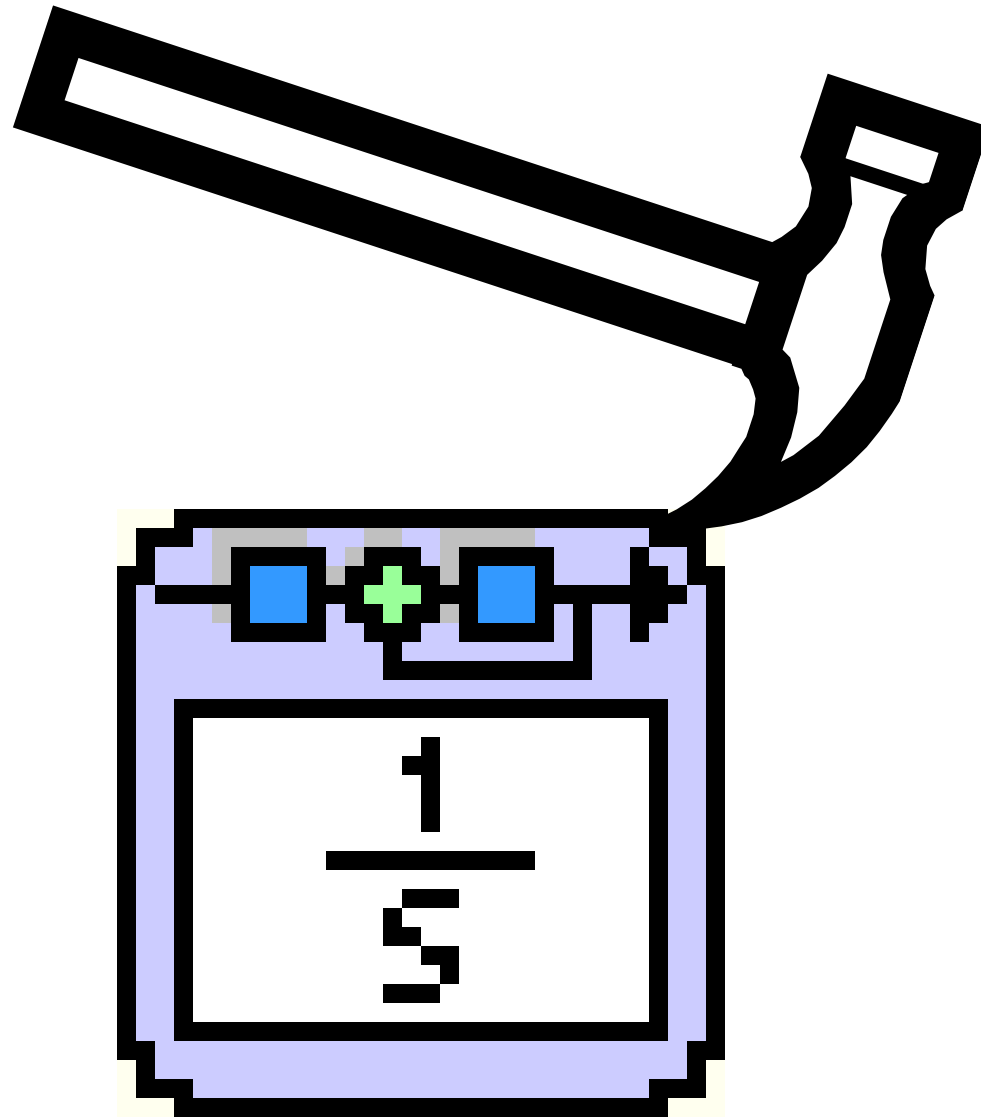


Value...? Isn't it suppose to integrate an equation?

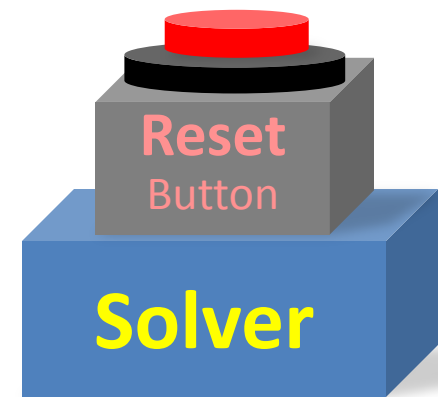
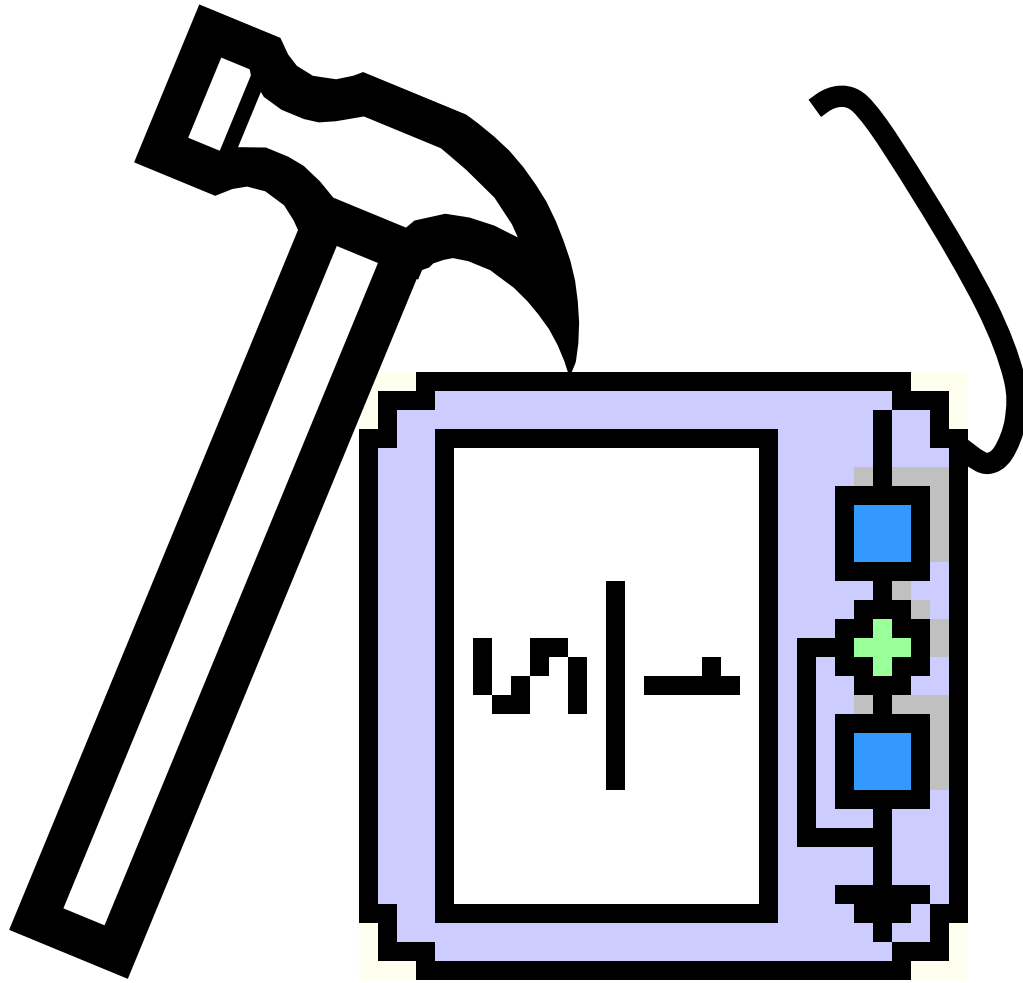
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**Let's
look
inside...**

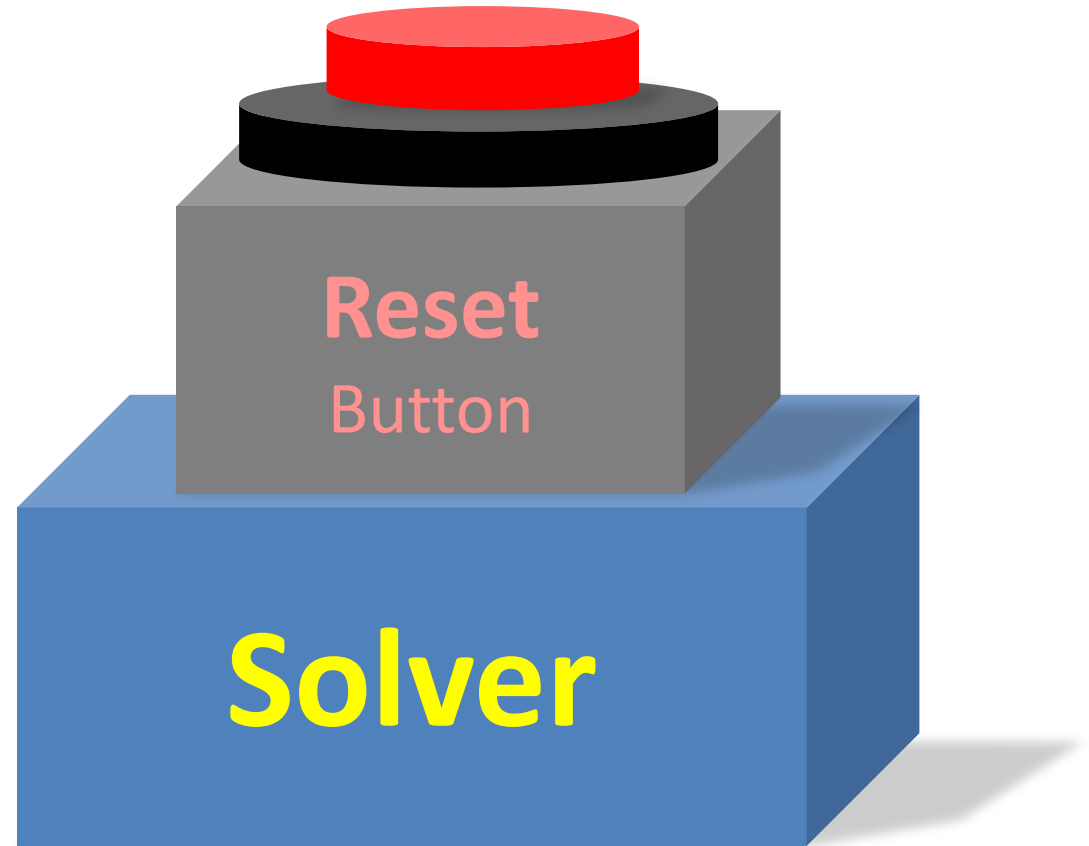
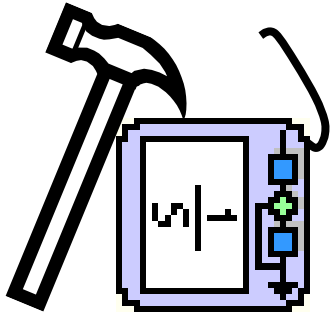
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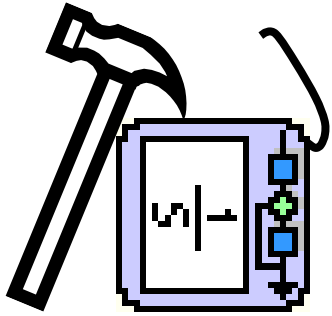
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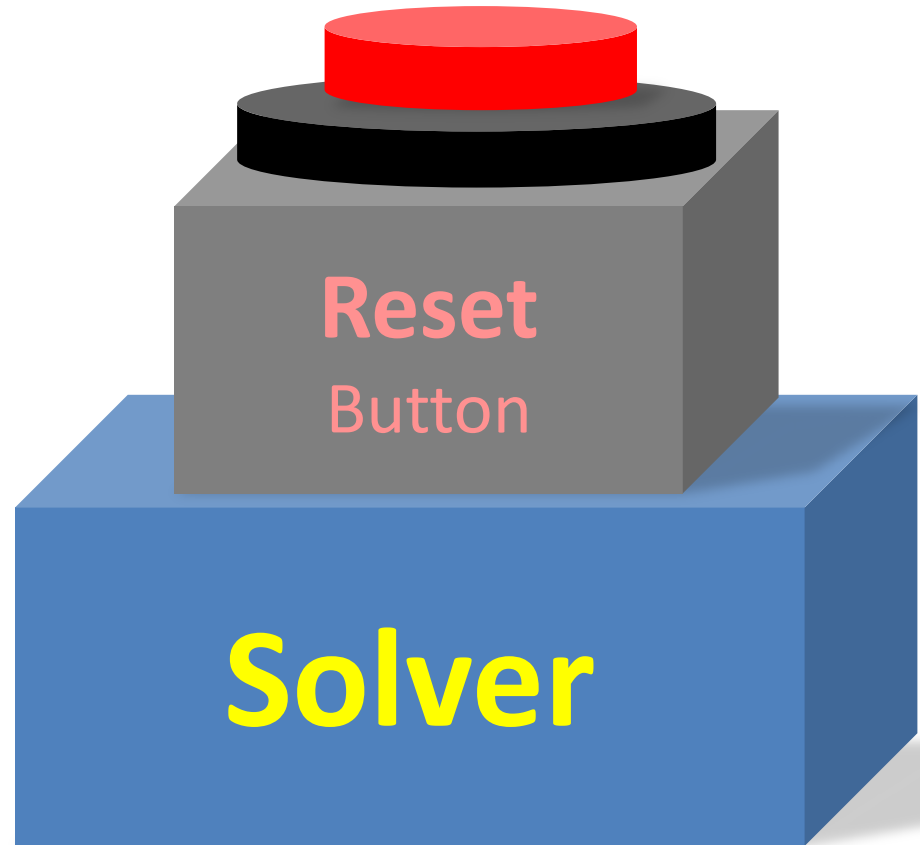
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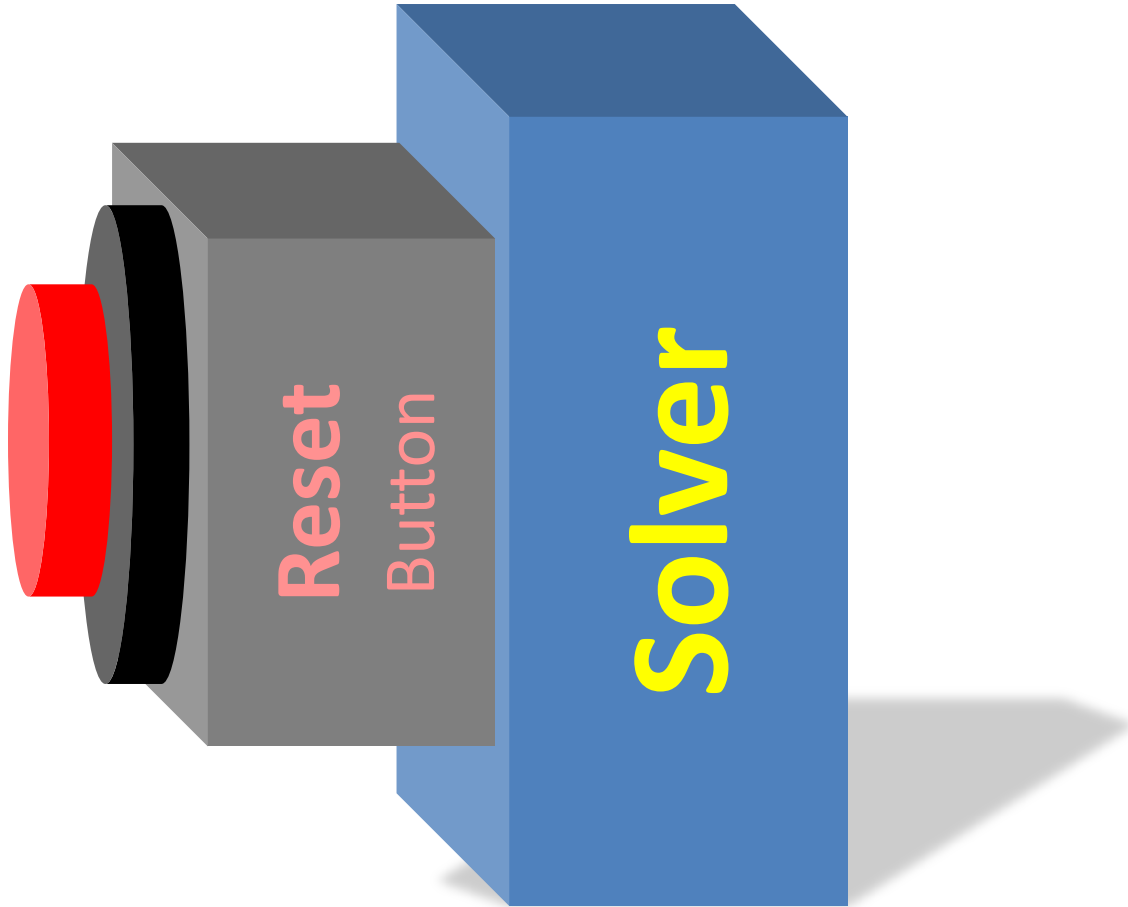
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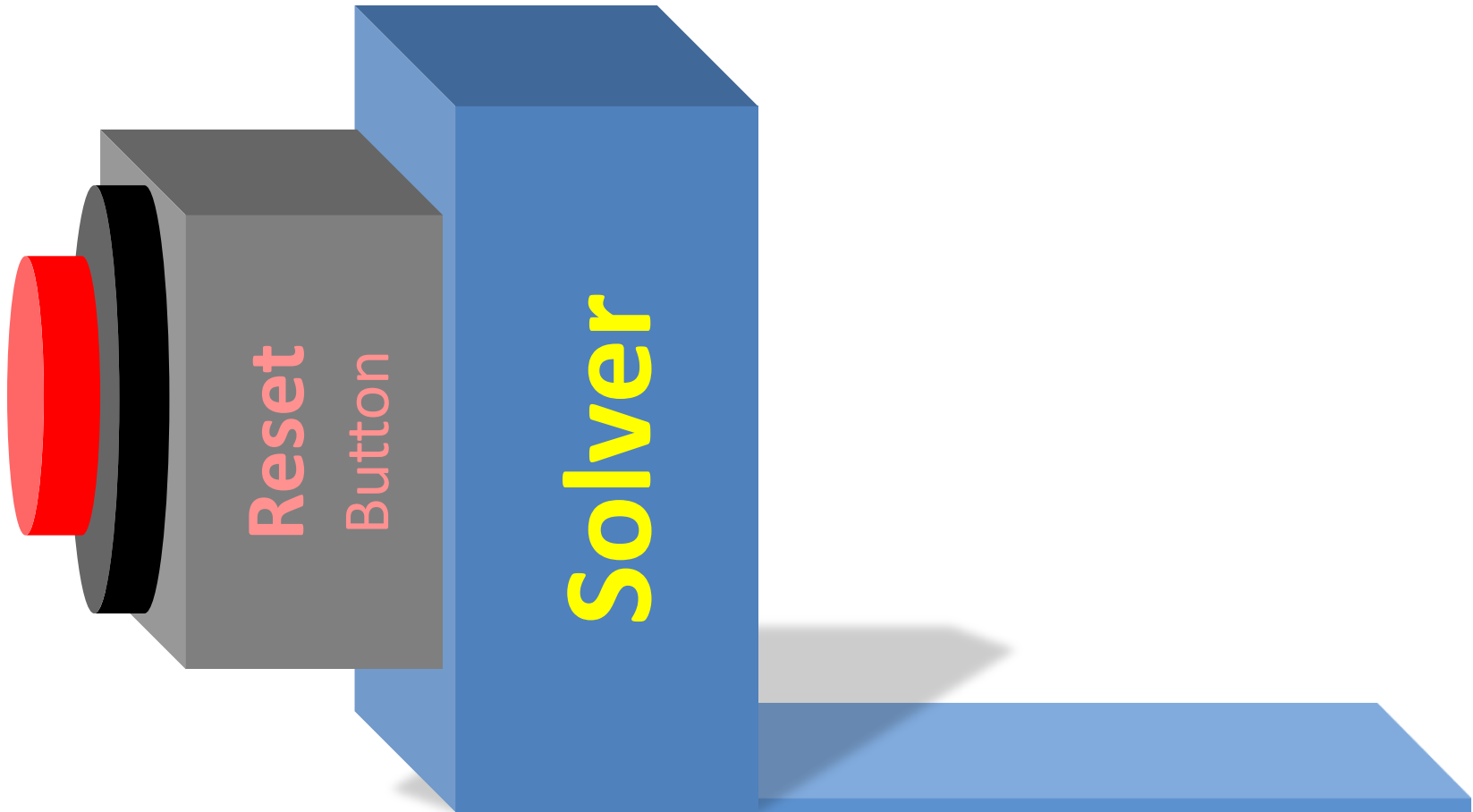
**What's in the
Solver?**



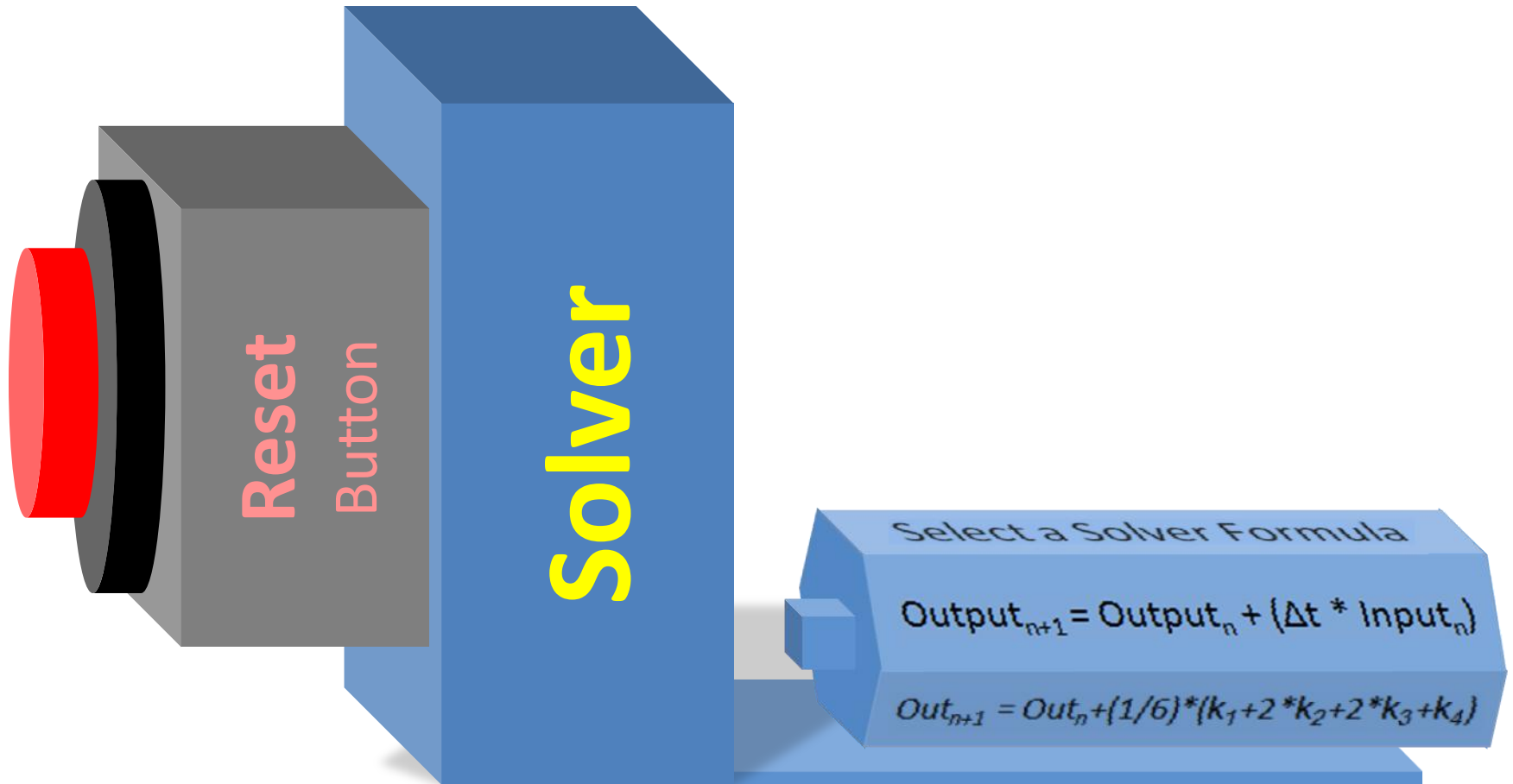
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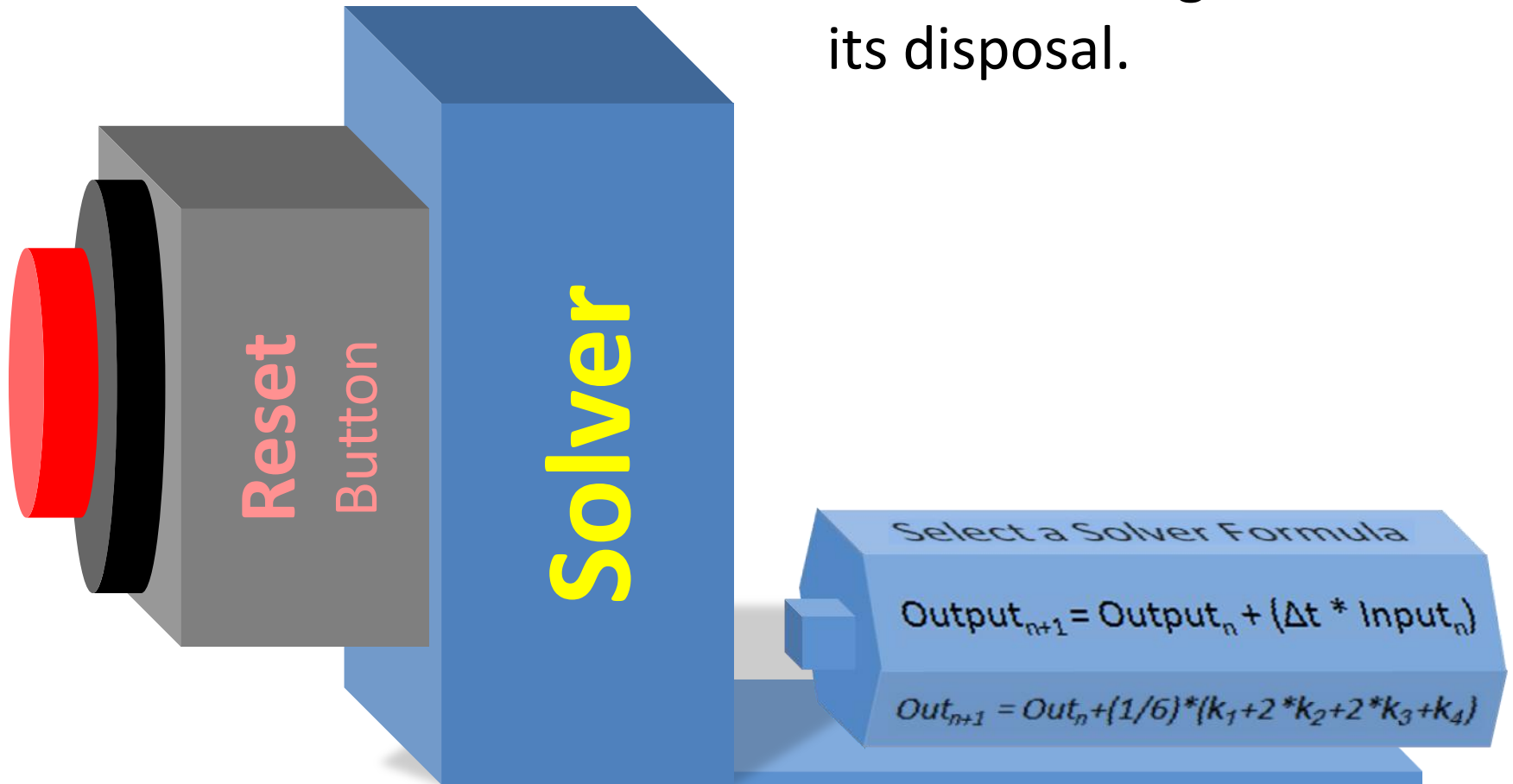


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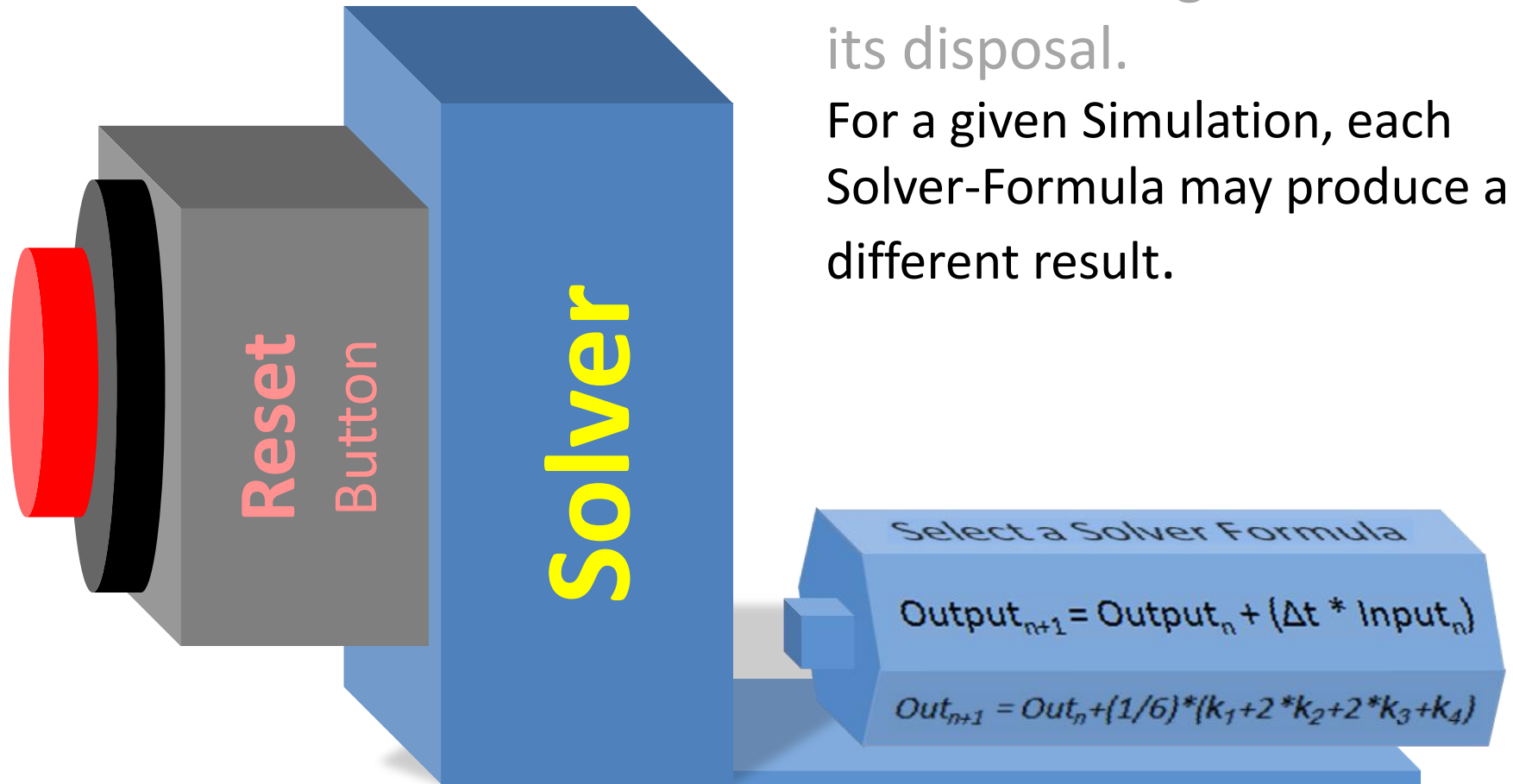


An Interpretation of How Simulation Software might Work

An Integrator's Solver has several solving-formulas at its disposal.

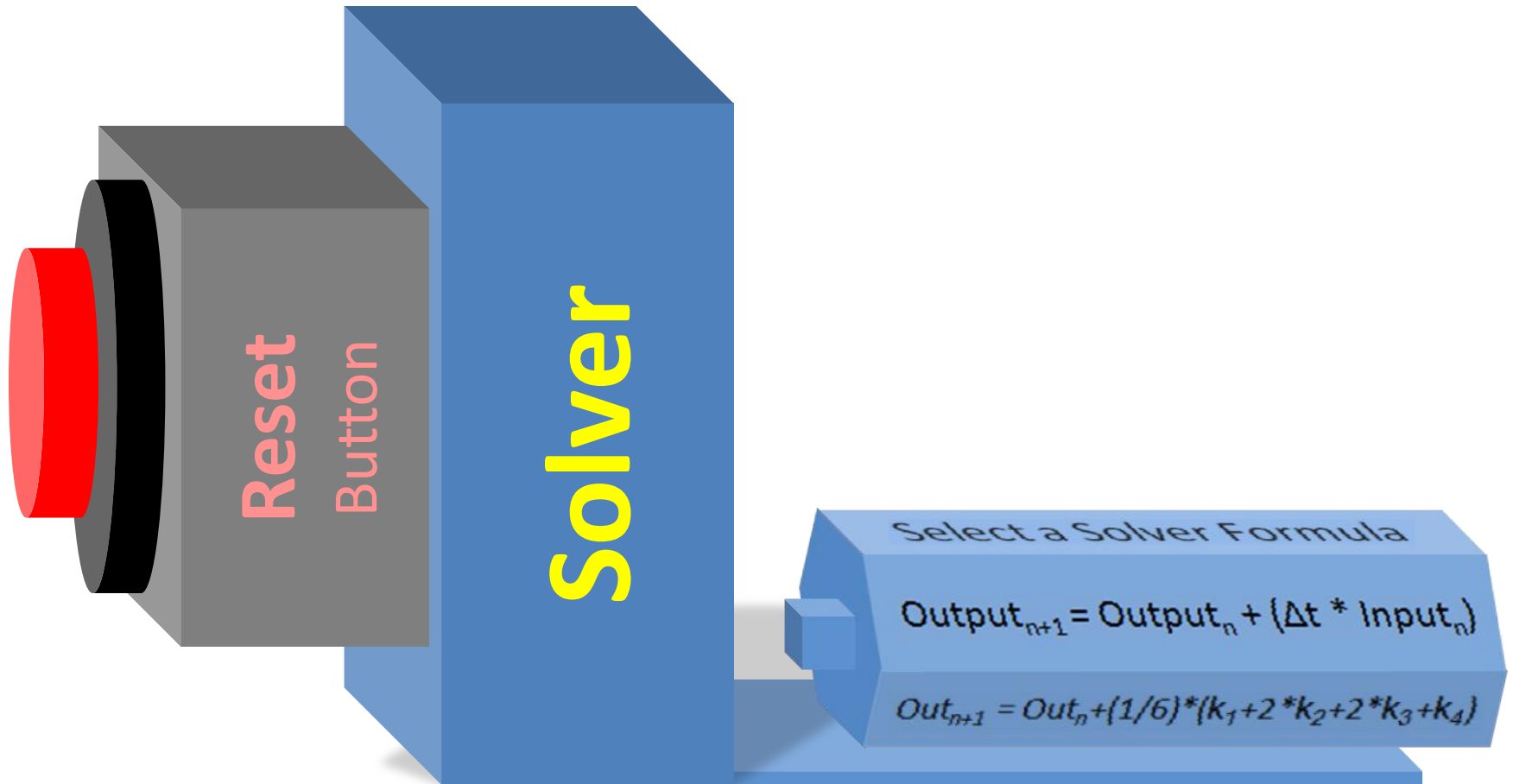


An Interpretation of How Simulation Software might Work

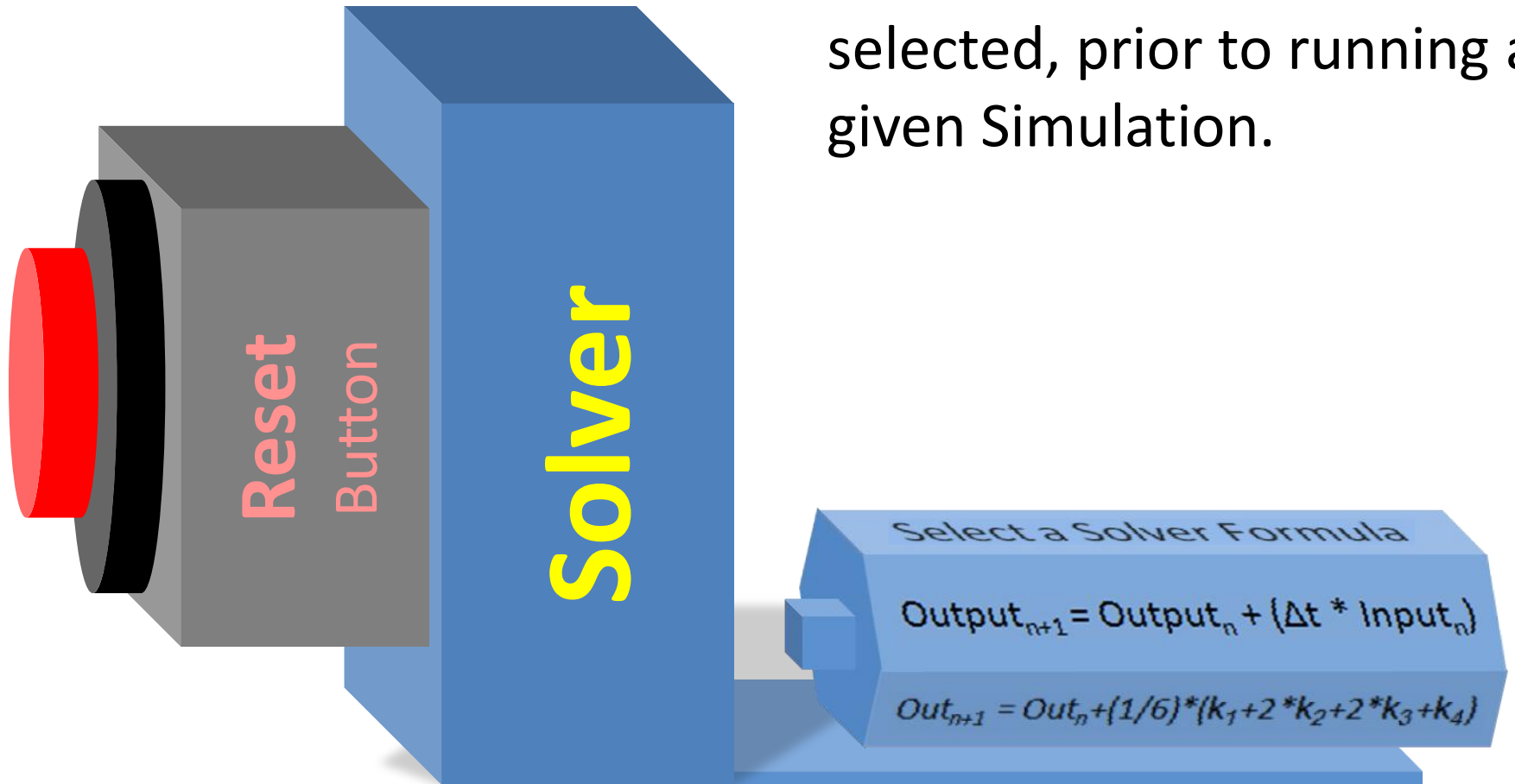


An Interpretation of How Simulation Software might Work

Note:



An Interpretation of How Simulation Software might Work

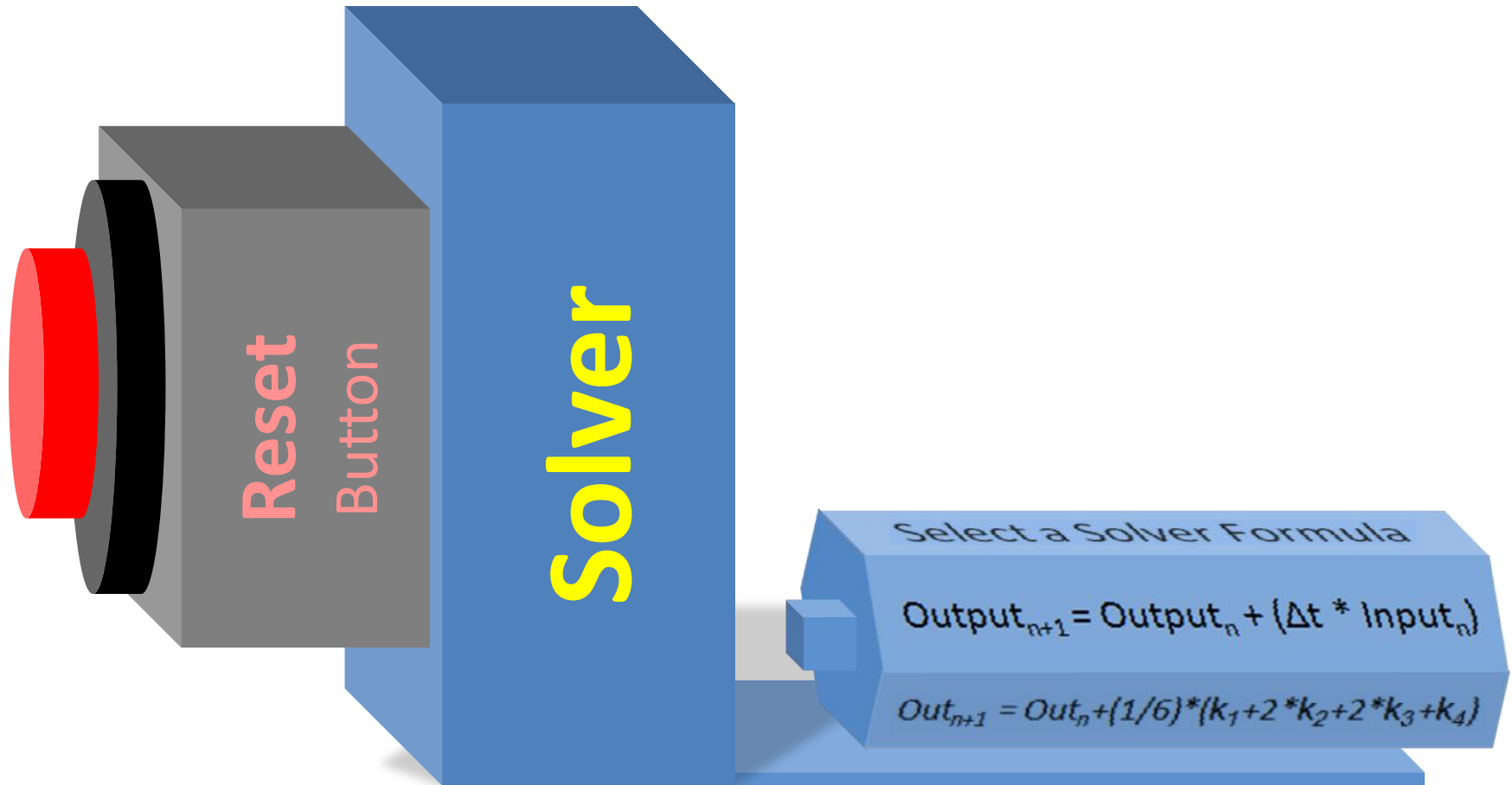


Note:

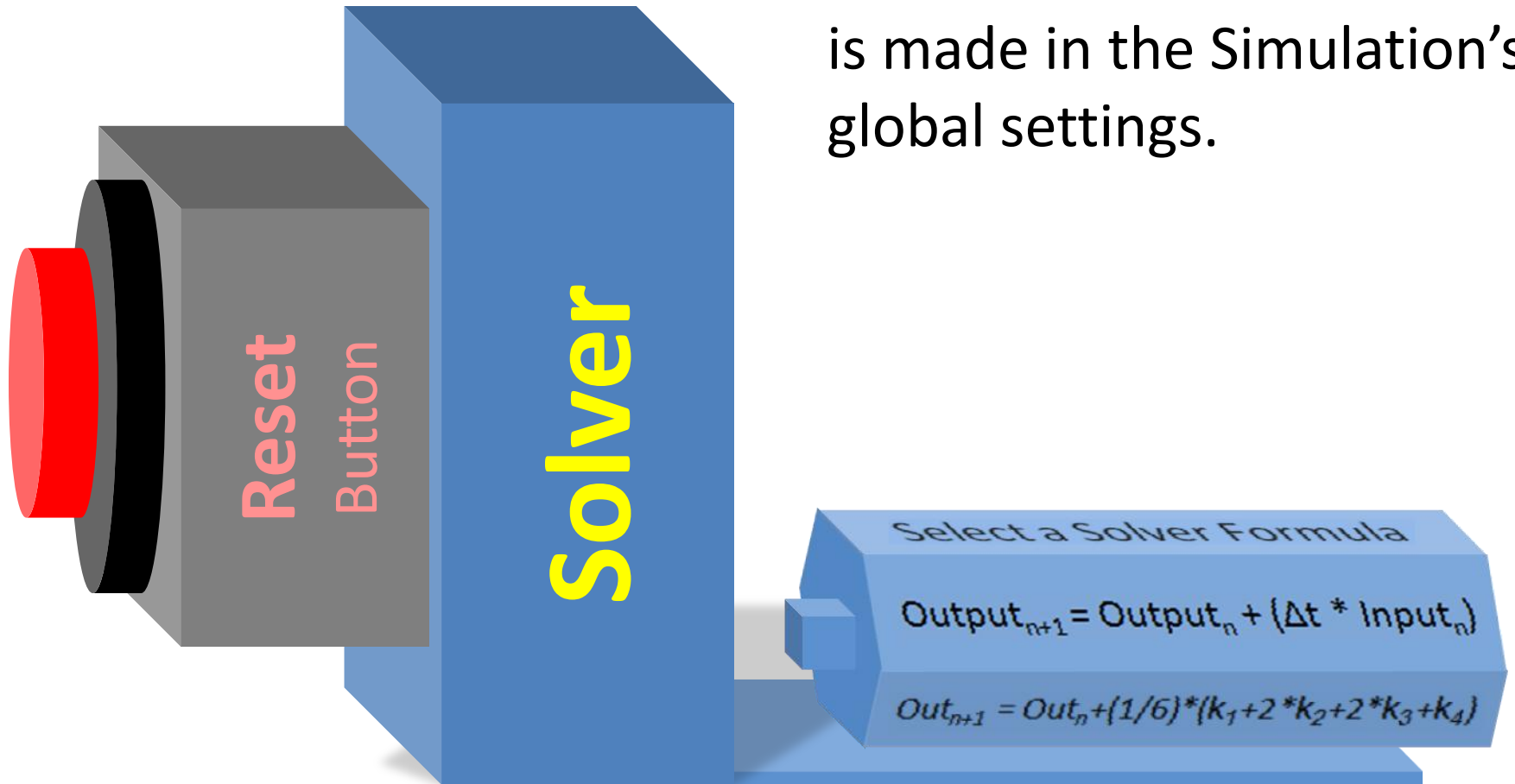
A Solver-Formula is selected, prior to running a given Simulation.

An Interpretation of How Simulation Software might Work

Also note:



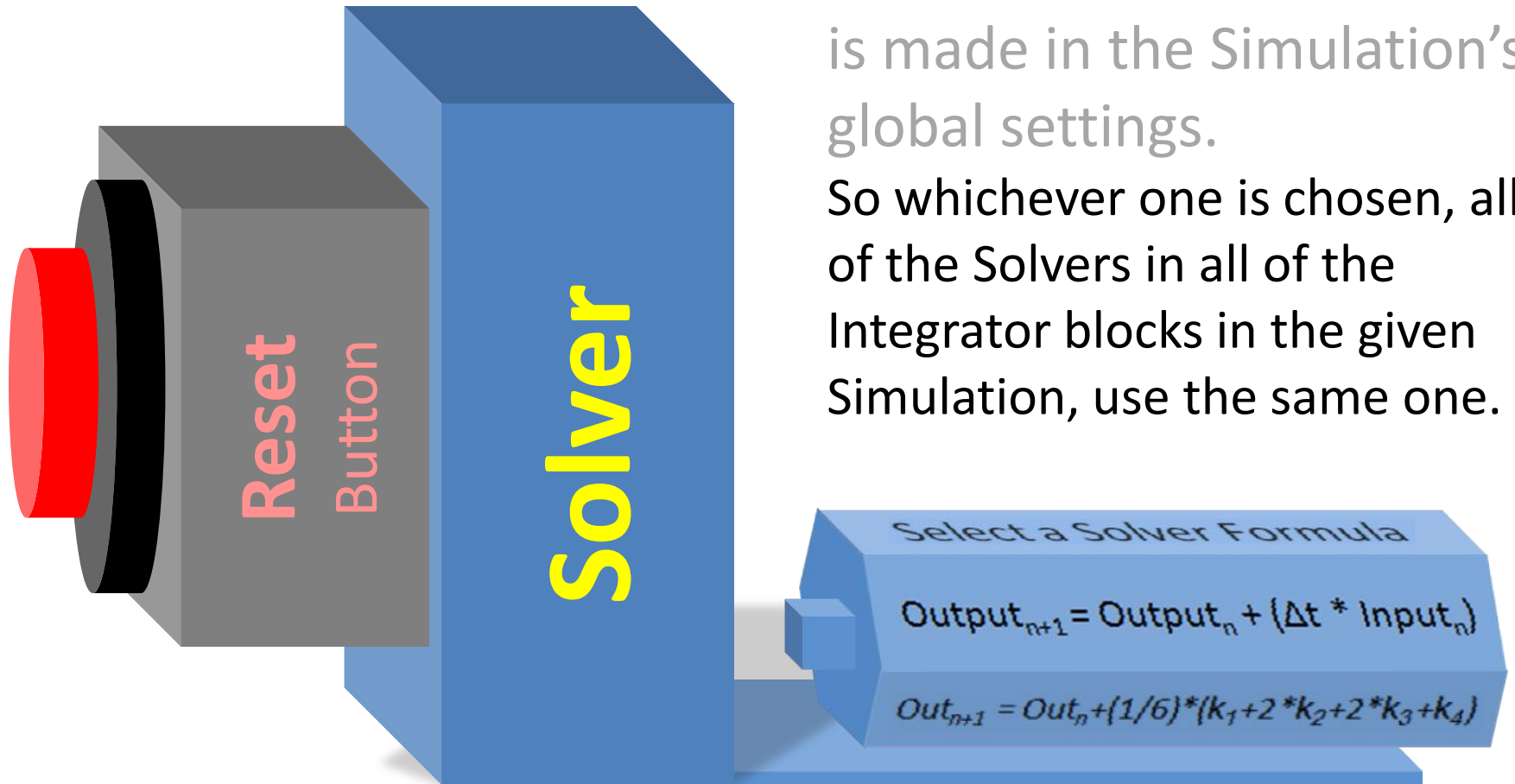
An Interpretation of How Simulation Software might Work



Also note:

The Solver-Formula choice is made in the Simulation's global settings.

An Interpretation of How Simulation Software might Work



Also note:

The Solver-Formula choice is made in the Simulation's global settings.

So whichever one is chosen, all of the Solvers in all of the Integrator blocks in the given Simulation, use the same one.

To be continued...