Miscellaneous models

Minimal model

```
<MorpheusModel>
   <minimal/>
</MorpheusModel>
```


Minimal valid XML model

Aim

This example does nothing - expect being the minimal valid Morpheus model.

Such a model is generated when choosing `File → New`.

Description

The basic model only includes the required nodes `MorpheusModel`, `Description`, `Space` and `Time`. Their required nodes and attributes are added recursively, such as `Lattice class` and `StopTime value`.

Try it!

- Invalidate this minimal model by editing it (but keeping it well-formed). For example, remove `Time/StopTime`. Then try to load it in `morpheus-gui`. This should trigger a warning saying that what went wrong, and how it was solved. Check the `Fixboard` to see the changes the morpheus made.

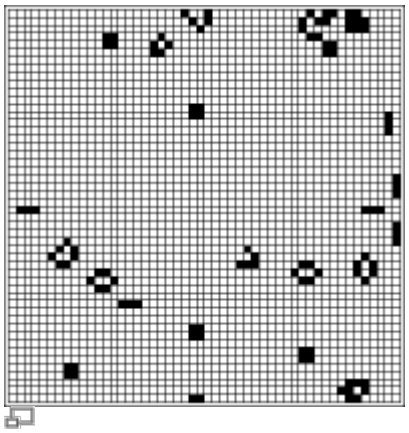
Model

Minimal.xml

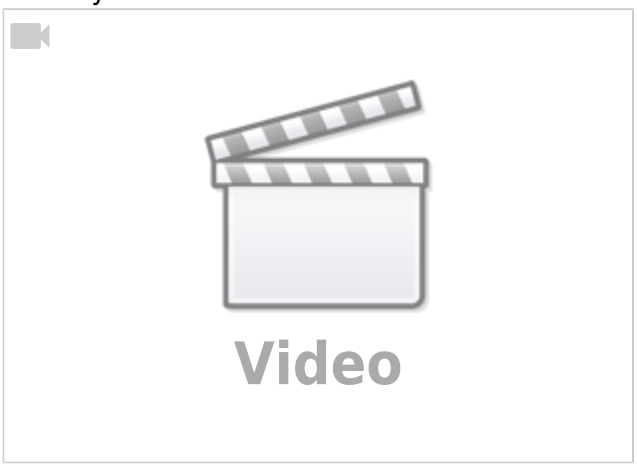
```
<?xml version='1.0' encoding='UTF-8'?>
<MorpheusModel version="1">
    <Description>
        <Title></Title>
    </Description>
    <Space>
        <Lattice class="linear">
            <Size value="0 0 0"/>
        </Lattice>
    </Space>
    <Time>
        <StartTime value="1.0"/>
        <StopTime value="1.0"/>
```

```
    </Time>
</MorpheusModel>
```

Game of Life: Cellular Automata



Conway's Game of Life



Introduction

This example models probably the best-known classic cellular automaton (CA) model: Conway's Game of Life.

It shows an alternative use of `System` for synchronous updating of `Equations`.

Model description

In this model, the lattice is filled with cells of size 1. Each cell counts the number of neighboring cells that are 'alive' and acts accordingly. The rules that make up the Game of Life are implemented in a `System` of `Equations` in which all `Equations` are updated synchronously.

Things to try

- Change the Neighborhood from a Moore (2nd order) to von Neumann (1st order).

Full model

h GameOfLife.xml |h

```
extern>http://imc.zih.tu-dresden.de/morpheus/examples/Miscellaneous/GameOfLife.xml
```

In Morpheus GUI: File → Examples → Miscellaneous → GameOfLife.xml

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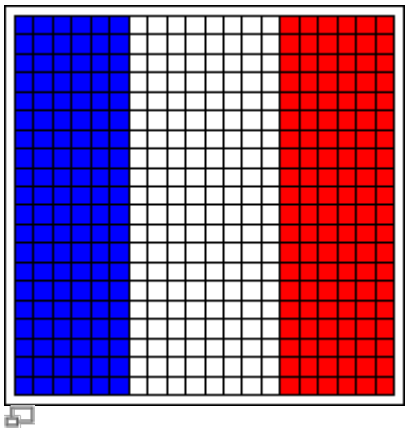
French Flag: Morphogen gradient



Wolpert's French Flag

Introduction

This example shows Wolpert's classical French Flag model. Depending on the local concentration of a morphogen, cells adopt one of three cell types based on internal thresholds.

Model description

The model sets up a morphogen gradient in the x direction PDE. Note that no diffusion is used, since we use the steady-state solution of diffusion.

The cells in CellType register the (average) local morphogen concentration using PDEReporter. Based on the specified threshold values, they choose an identity I as defined in the Equation.

Note that this model is not time-dependent. Time is therefore set from StartTime 0 to StopTime 0.

- Change the physical length of the domain by editing Space → NodeLength that controls the physical size per lattice site.
- Change the model such that the morphogen gradient is set up by production and diffusion,

using `Diffusion` and a `System` with `DiffEqn`. That is, change the model into a time-dependent model.

Full model

h FrenchFlag.xml |h

```
extern>http://imc.zih.tu-dresden.de/morpheus/examples/Miscellaneous/FrenchFlag.xml
```

In Morpheus GUI: `File → Examples → Miscellaneous → FrenchFlag.xml`.
