OpenModelica
OMShell and OMNotebook
Introduction and Exercises

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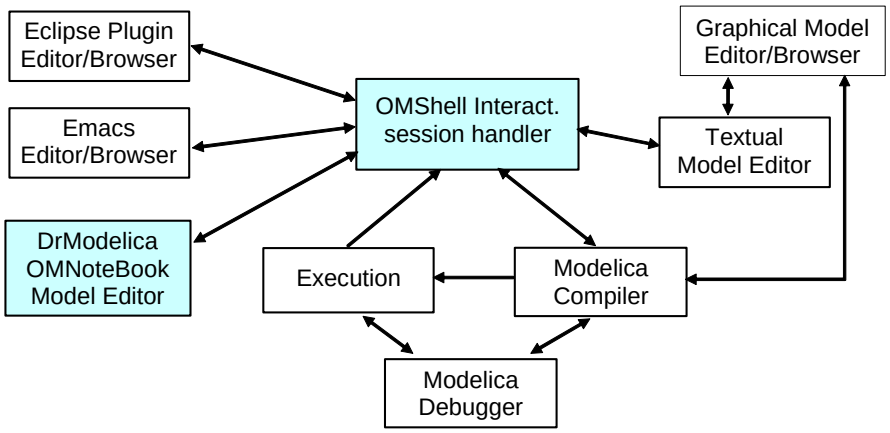
OMShell and OMNotebook OpenModelica End-User Subsystems

- OMShell – interactive session handler for Modelica scripting
- OMNotebook – interactive electronic notebook for Modelica teaching (with DrModelica), scripting, and documentation
- OpenModelica Compiler (OMC) – compiles and executes/simulates Modelica models
- ptplot package (from Berkeley) make plots

OpenModelica Environment Architecture

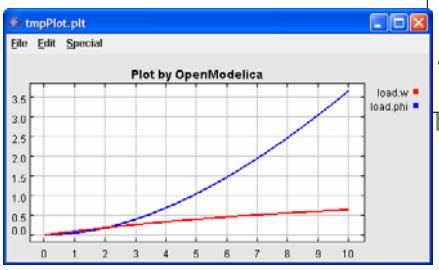


Interactive Session Handler – on dcmotor Example

(Session handler called OMShell – OpenModelica Shell)

```
>>simulate(dcmotor,startTime=0.0,stopTime=10.0)
>>plot({load.w,load.phi})
```

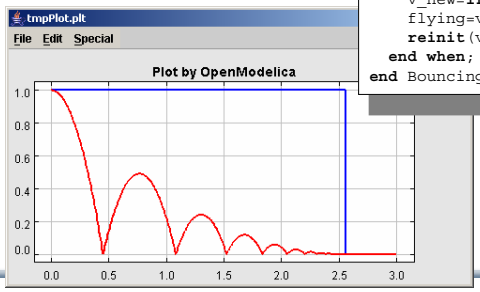
```
model dcmotor
  Modelica.Electrical.Analog.Basic.Resistor r1(R=10);
  Modelica.Electrical.Analog.Basic.Inductor i1;
  Modelica.Electrical.Analog.Basic.EMF emf1;
  Modelica.Mechanics.Rotational.Inertia load;
  Modelica.Electrical.Analog.Basic.Ground g;
  Modelica.Electrical.Analog.Sources.ConstantVoltage v;
equation
  connect(v.p,r1.p);
  connect(v.n,g.p);
  connect(r1.n,i1.p);
  connect(i1.n,emf1.p);
  connect(emf1.n,g.p);
  connect(emf1.flange_b,load.flange_a);
end dcmotor;
```



Event Handling by OpenModelica – BouncingBall

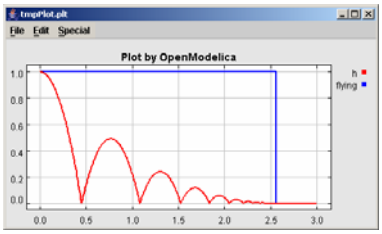
```
>>simulate(BouncingBall,
          stopTime=3.0);
>>plot({h,flying});
```

```
model BouncingBall
  parameter Real e=0.7 "coefficient of restitution";
  parameter Real g=9.81 "gravity acceleration";
  Real h(start=1) "height of ball";
  Real v "velocity of ball";
  Boolean flying(start=true) "true, if ball is flying";
  Boolean impact;
  Real v_new;
equation
  impact=h <= 0.0;
  der(v)=if flying then -g else 0;
  der(h)=v;
  when {h <= 0.0 and v <= 0.0,impact} then
    v_new=if edge(impact) then -e*pre(v) else 0;
    flying=v_new > 0;
    reinit(v, v_new);
  end when;
end BouncingBall;
```



Run Scripts in OpenModelica

- RunScript command interprets a .mos file
- .mos means MOdelica Script file
- Example:
  `>> runScript("sim_BouncingBall.mos")`



The file sim_BouncingBall.mos :

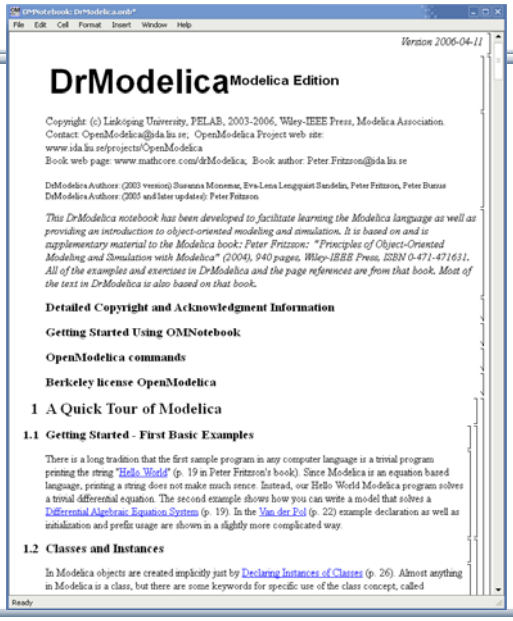
```
loadFile("BouncingBall.mo");
simulate(BouncingBall, stopTime=3.0);
plot({h,flying});
```

Some OMShell Exercises

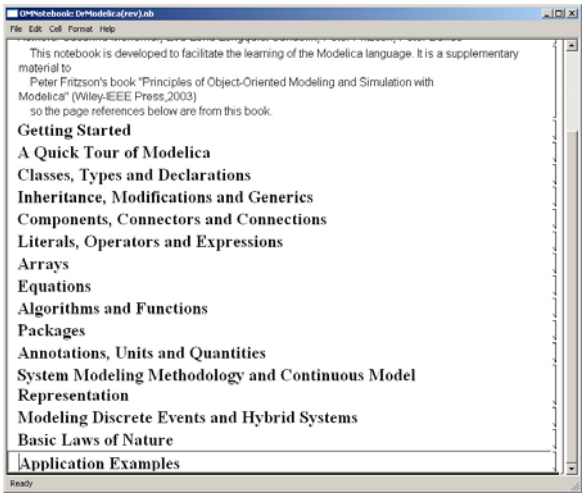
- Start OMShell (e.g. from the start menu)
- Look at the examples in the OpenModelicaUsersGuide.
- Try evaluating a small expression, e.g. 2+3, push return
- type help()
- try command completion, e.g. type loadM followed by tab
- fill in Modelica (i.e. loadModel(Modelica))
- Use the file menu->LoadModel and load the dcmotor (../testmodels)
- type sim followed by tab; fill in dcmotor
- type plot followed by tab; fill in some variable(s) to plot (look at the users guide)
- type in a small function and call it

OpenModelica OMNotebook Electronic Notebook with DrModelica

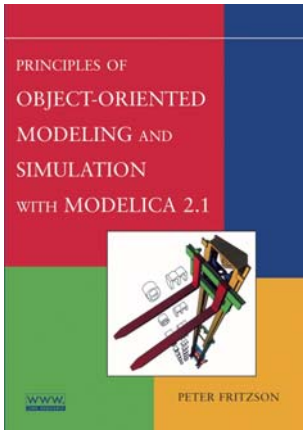
- Primarily for teaching
- Interactive electronic book
- Platform independent
- OMNotebook Does not need Mathematica



Interactive Contents in DrModelica Contains Examples and Exercises from Modelica Book

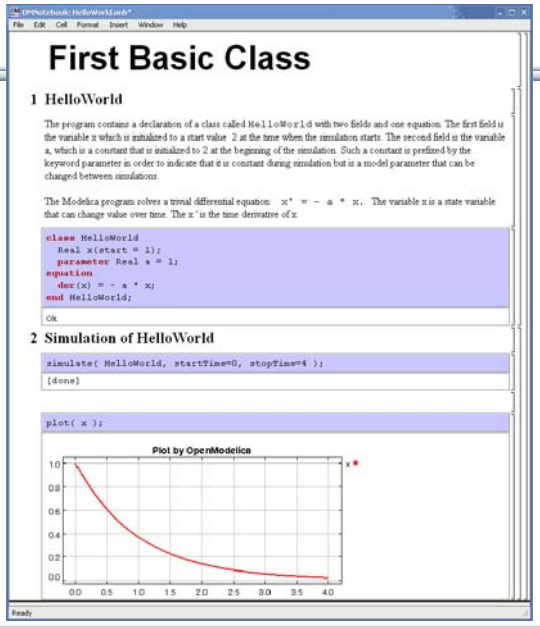


Recent Book, 2004:

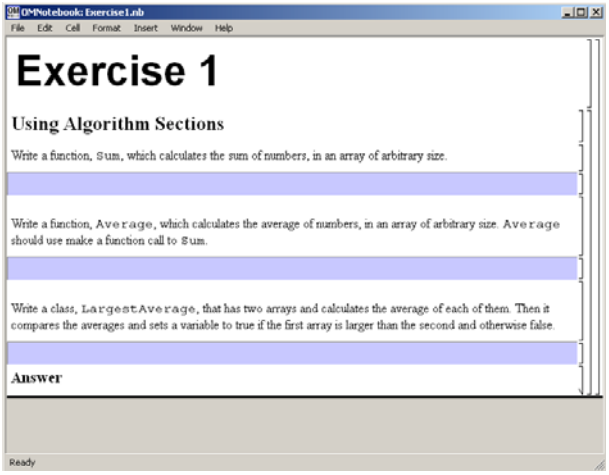


Cells with both Text and Graphics

- **Java must be installed for plotting to work**



Exercises and Answers in OMNotebook DrModelica



Some OMNotebook Commands
(see also OpenModelica Users Guide)

- Shift-return (evaluated a cell)
- File Menu (open, close, etc.)
- Text Cursor (vertical), Cell cursor (horisontal)
- Cell types: text cells & executable code cells
- Copy, paste, group cells
- Copy, pase, group text
- Command Completion (shift-tab)

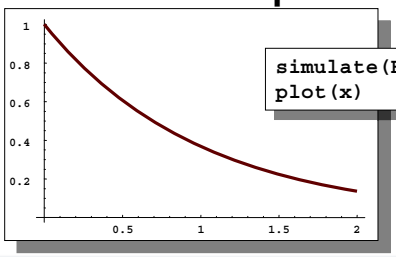
Simplest Model – Hello World!

A Modelica "Hello World" model

Equation: x' = - x
Initial condition: x(0) = 1

```
class HelloWorld "A simple equation"
  Real x(start=1);
equation
  der(x)= -x;
end HelloWorld;
```

Simulation in OpenModelica environment

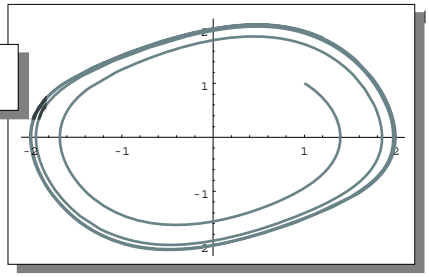



```
simulate(HelloWorld, stopTime = 2)
plot(x)
```


Example class: Van der Pol Oscillator

```
class VanDerPol  "Van der Pol oscillator model"
  Real x(start = 1)  "Descriptive string for x"; // x starts at 1
  Real y(start = 1)  "y coordinate";             // y starts at 1
  parameter Real lambda = 0.3;
equation
  der(x) = y;                          // This is the 1st diff equation //
  der(y) = -x + lambda*(1 - x*x)*y;  /* This is the 2nd diff equation */
end VanDerPol;
```

```
simulate(VanDerPol,stopTime = 25)
plotParametric(x,y)
```



Small OMNotebook Exercise

- Locate the HelloWorld model in DrModelica using OMNotebook!
- Simulate and plot the example. Do a slight change in the model, re-simulate and re-plot.

```
class HelloWorld "A simple equation"
  Real x(start=1);
equation
  der(x)= -x;
end HelloWorld;
```

```
simulate(HelloWorld, stopTime = 2)
plot(x)
```

- Locate the VanDerPol model in DrModelica and try it!
- Do some change and re-simulate

Small OMNotebook Exercises cont.

- Select and copy a cell (tree to the right)
- Position the horizontal cell cursor: first click between cells; then click once more on top of the horizontal line
- Paste the cell

- Note: You can find most Users Guide examples in the UsersGuideExamples.onb in the testmodels directory