Performance measurements and Benchmarking of the OpenModelica compiler

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Part 1:

1. Introduction
2. Benchmark Models
3. Results
4. Conclusion

Part 2:

Adrian
1. Introduction

Necessity of Performance Measurements and Benchmarks

- Enhance implementation
- Compare different implementation
- Point out inefficient parts of the compiler
- Comparison with other compilers
- Objective measurement for evolution of compiler
2. Benchmarking

The Benchmark

- Synthetic models testing specific aspects of the compiler
- Focus lies on large models
- Benchmarks automated using Python
- will be presented at the Modelica Conference 2011

All benchmarks performed on Windows 7, 64 bit system with Intel Core i7 860, 2.80 GHz and 4.0 GB RAM
2. Models

Benchmark: evaluate performance regarding large models

Flat Model:

```model flatclass_n
  input Real inp;
  Real v_1;
  Real v_2;
  Real v_3;
  ...
  Real v_n;
  equation
    v_1 = 1 + v_2;
    v_2 = 2 + v_3;
    ...
    v_(n-1) = (n-1) + v_n;
    der(v_n) = v_1 + inp;
end flatclass_n;
```

Hierarchical Model:

<table>
<thead>
<tr>
<th>Level</th>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>84</td>
</tr>
<tr>
<td>4</td>
<td>168</td>
</tr>
</tbody>
</table>
Benchmark: Remove Alias Equations

model AliasClass_N
  input Real inp;
  constant Integer N=4;
  Real a[2*N+1];
equation
  der(a[1]) = inp;
a[2] = -a[1];
  for i in 4:2:2*N loop
    a[i] = a[i-3] + a[i-2] - a[i-1];
a[i+1] = i*a[i]+(i-1)*a[i-1];
  end for;
end AliasClass_N;

Simplifies to

model AliasClass_N
  input Real inp;
  constant Integer N=4;
  Real a[2*N+1];
equation
  der(a[1]) = inp;
a[2] = -a[1];
a[3] = -a[1];
a[4] = a[1];
a[5] = a[1];
a[6] = -a[1];
a[7] = -a[1];
  end for;
end AliasClass_N;
3. Results

Performance measurements and benchmarking of the OpenModelica compiler

Results

Translation

Number of Equations

Time [s]

OMC 1.5.0 Flat Class
OMC - 7850 Flat Class
3. Results

Performance measurements and benchmarking of the OpenModelica compiler
3. Results

Results

Simulation

Number of Equations

Time[s]

OMC 1.5.0 Flat Class
OMC - 7850 Flat Class
OMC 1.5.0 Hierarchical Model
OMC - 7850 Hierarchical Model
Results

3. Results

Performance measurements and benchmarking of the OpenModelica compiler

Linköping. 07/02/2011

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Results

3. Results

![Graph showing performance measurements and benchmarking of the OpenModelica compiler. The x-axis represents the number of equations, and the y-axis represents the time for simulation. Two lines are shown: one for OMC 1.5.0 sim and another for OMC 7850 sim.]
4. Conclusion

- Maximum treatable model size increased from around 10,000 to 40,000 equations
- Faster compilation process for models with fine grained class structure
- More work during translation done, time for translation remained equal
- Method available to test the influence of new features/implementations
- Method to check specific parts of the compiler
The End Part 1

»Wissen schafft Brücken.«

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