Integrated Modelica Debugging

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Debugging a Modelica model

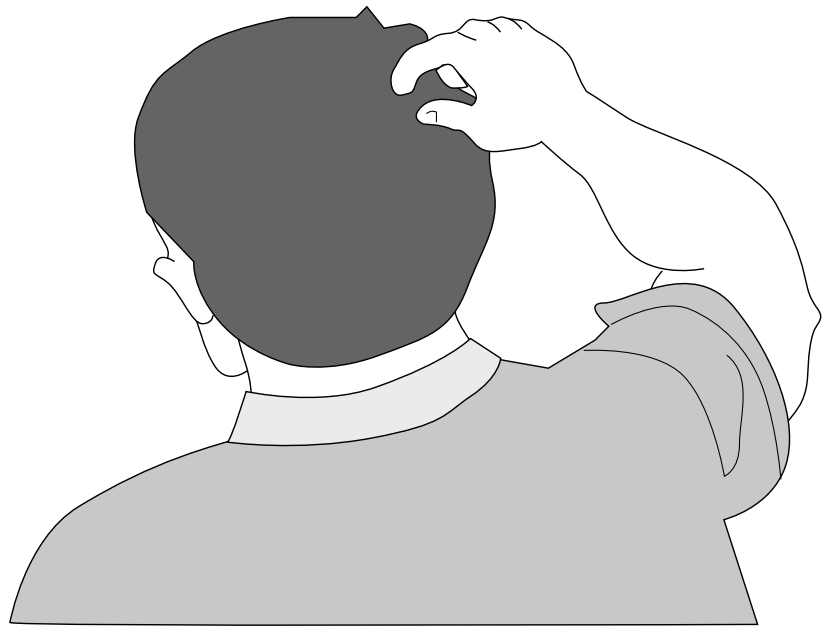
- Many things influence simulation
- No unique translation of equations to executable code
- Selection of state variables
- Sorting, matching
- Numerical methods
- Mapping errors back to source code

Creating a model with an error

```
model ChatteringEvents1 "Exhibits chattering after t =
    0.5, with generated events"
  Real x(start = 1, fixed = true);
  Real y;
  Real z;
equation
  z = if x > 0 then -1 else 1;
  y = 2 * z;
  der(x) = y;
  annotation(Documentation(info = "<html>
<p>After t = 0.5, chattering takes place, due to the
    discontinuity in the right hand side of the first
    equation.</p>
<p>Chattering can be detected because lots of tightly
    spaced events are generated. The feedback to the user
    should allow to identify the equation from which the
    zero crossing function that generates the events
    originates.</p>
</html>"), experiment(StopTime = 1));
end ChatteringEvents1;
```

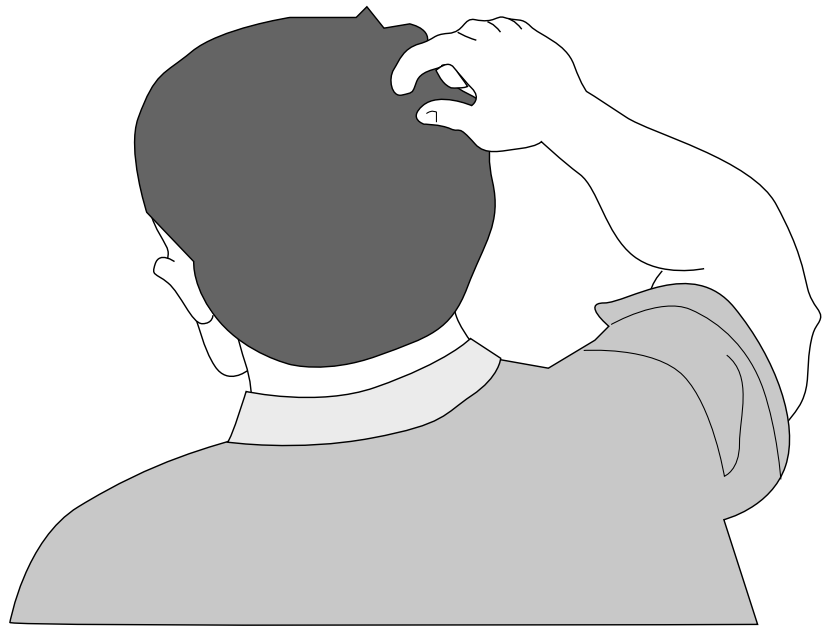
Simulating models with errors

- No error-message
- Cryptic error-message
- Simulation progressing slowly
  - Even fixed-step Euler solver is affected!
- Debugging is time-consuming



Simulating models with errors

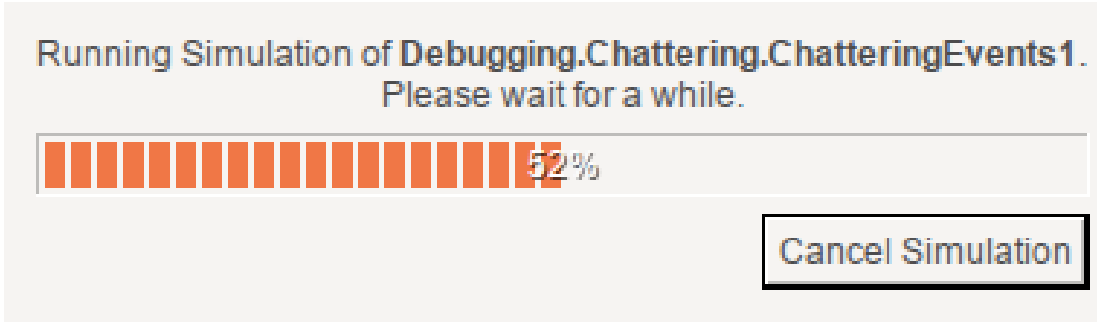
- No error-message
- Cryptic error-message
- Simulation progressing slowly
  - Even fixed-step Euler solver is affected!
- Debugging is time-consuming
- **You might not even find the error**

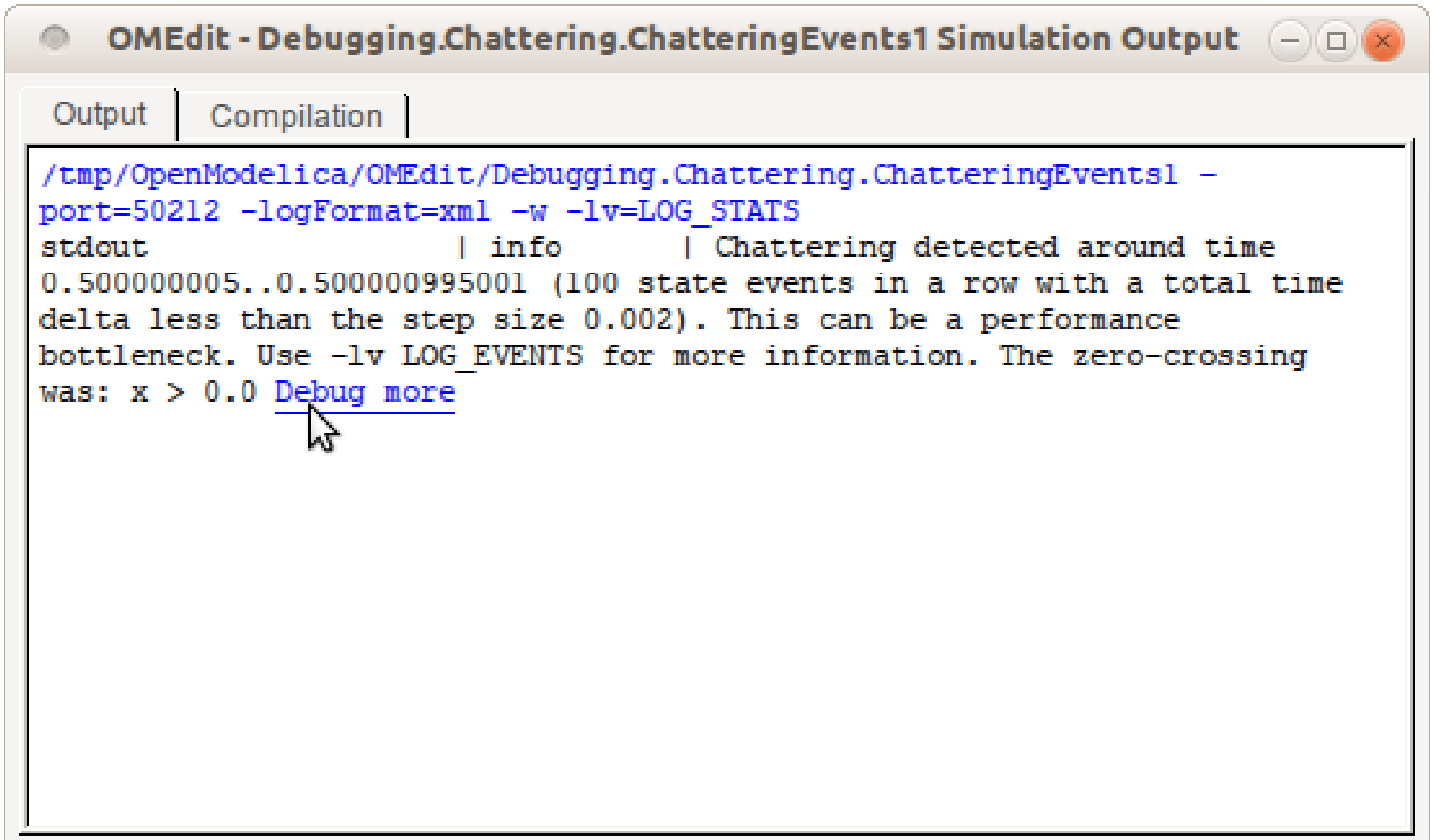


Compiler generates XML of performed transformations

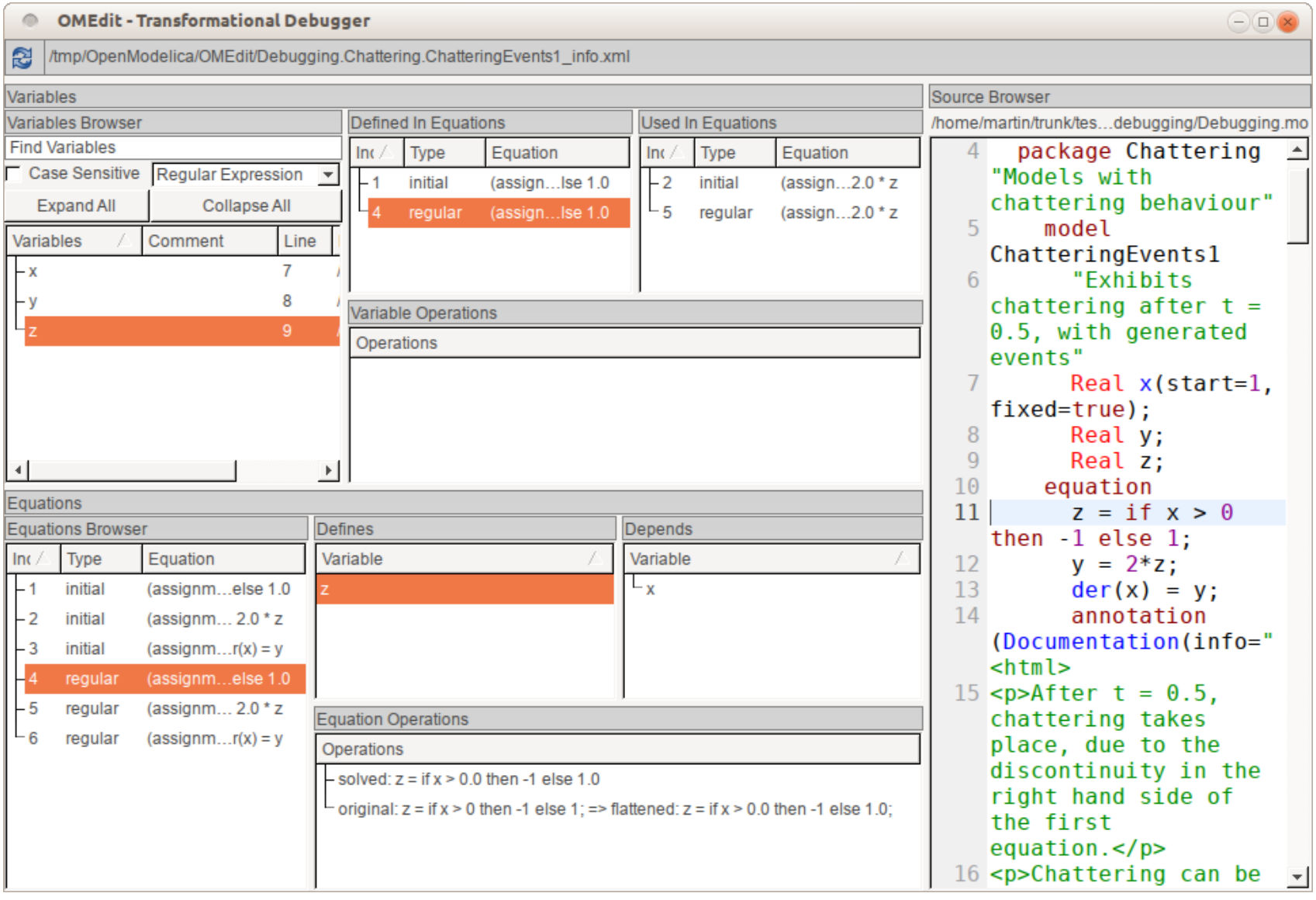
```
<solved>
  <lhs>revolute2.frame_b.t[2]</lhs>
  <rhs>-0</rhs>
</solved>
<simplify>
  <before>-revolute2.frame_b.t[2] = 0.292907999999999 *
      0.0 + 0.00831599999999999 * boxBody2.body.w_a[3] *
      0.0 + 0.25 * -0 + -0.292907999999999 * 0.0 *
      boxBody2.body.w_a[3]</before>
  <after>-revolute2.frame_b.t[2] = 0.0</after>
</simplify>
<!-- most things snipped -->
<flattening>
  <original>frame_a.t = I * z_a + cross(w_a, I * w_a) +
      cross(r_CM, frame_a.f);</original>
  <flattened>boxBody2.body.frame_a.t[2] = boxBody2.body.I
      [2,1] * ... - boxBody2.body.r_CM[1] * boxBody2.body.
      frame_a.f[3];</flattened>
</flattening>
```

Simulating a model with an error

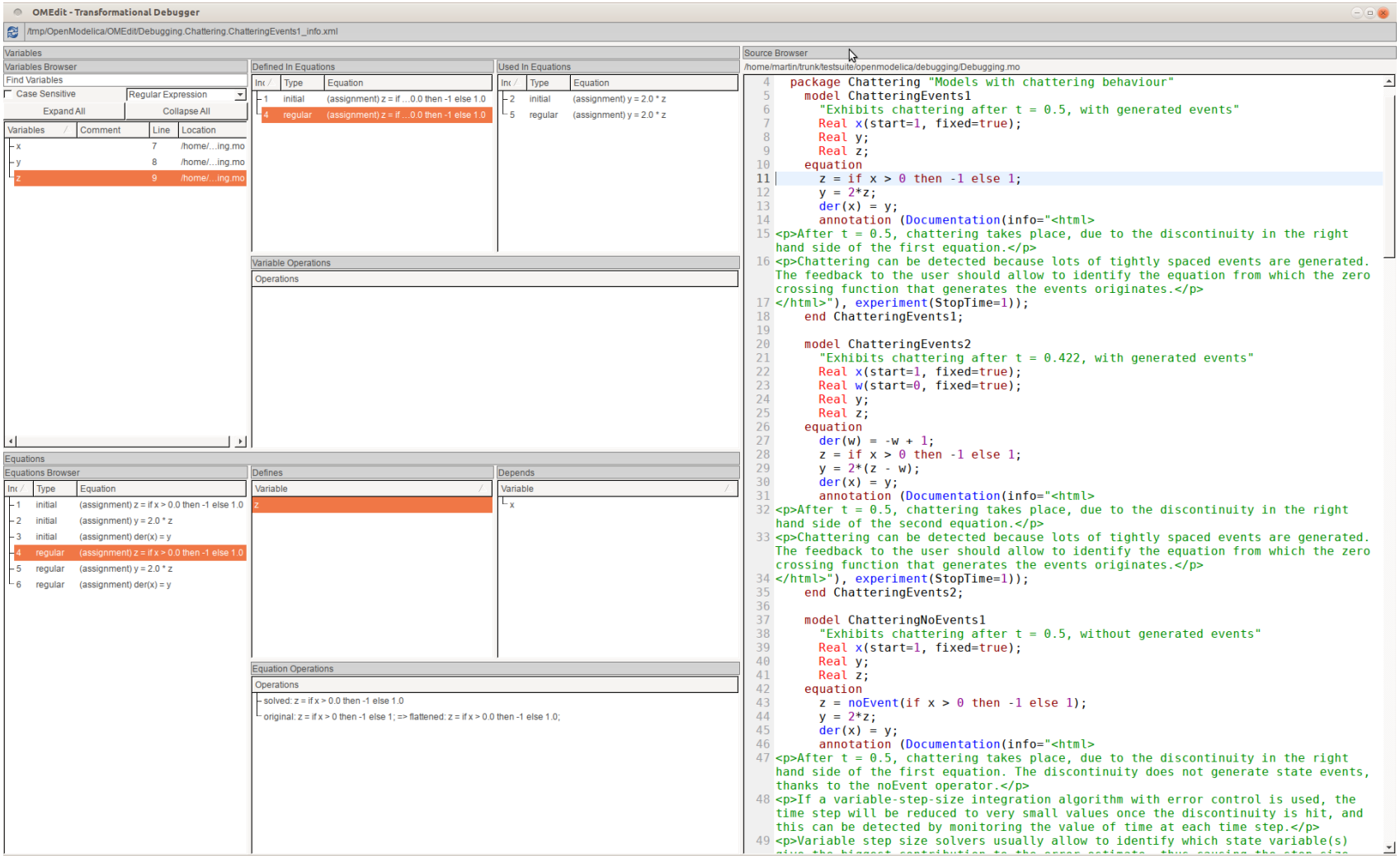




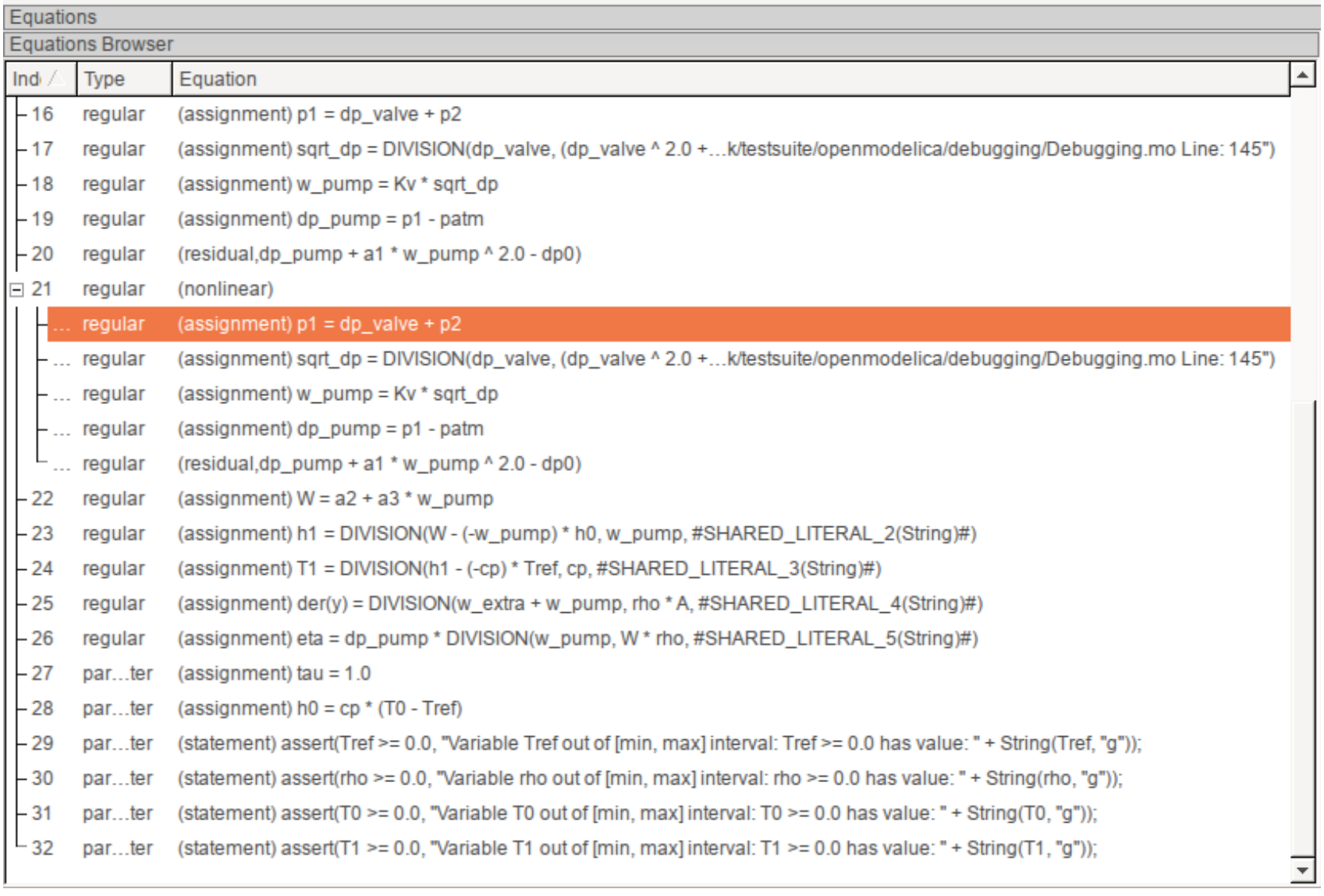
The Transformations Browser



The Transformations Browser (Overview)



The Transformations Browser (Nonlinear system)



Integration of Tools

- OpenModelica Compiler, info.xml files
- Simulation executables, xml output format
- OMEdit, reads simulation output and info.xml. Generates and opens the correct view

Future Work

- More specialised views (nonlinear/etc)
- Better diffs (colour-coded/etc)
- Trace more operations (tearing/etc)
- Integration with plotting / result-files
- Integration with the profiler