



# ReSim - Multitool regression testing for library development

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# Agenda

- Problem Specification
- MultiTool regression tests
  - for a single developer
  - for a team of developers
- Summary: What is the benefit of this regression testing tool ?
- How to get ReSIM ?

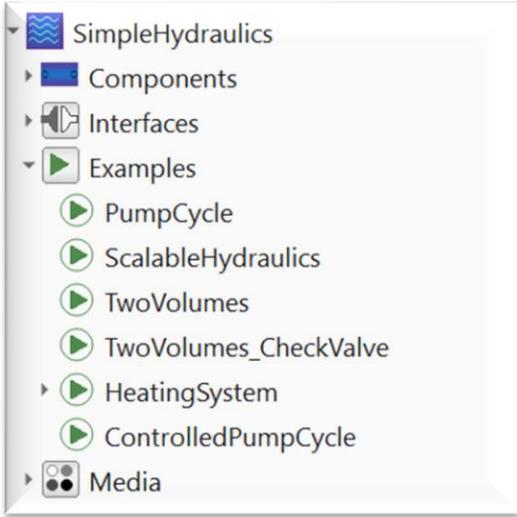
# Problem Specification



Robert: enthusiast in fluid simulation



He uses Dymola ...



... to develop his small Modelica library



He administrates it in a git repository

Robert's goal: make the library accessible in as many Modelica tools as possible



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....

<https://www.3ds.com/products/catia/dymola>

<https://openmodelica.org/>

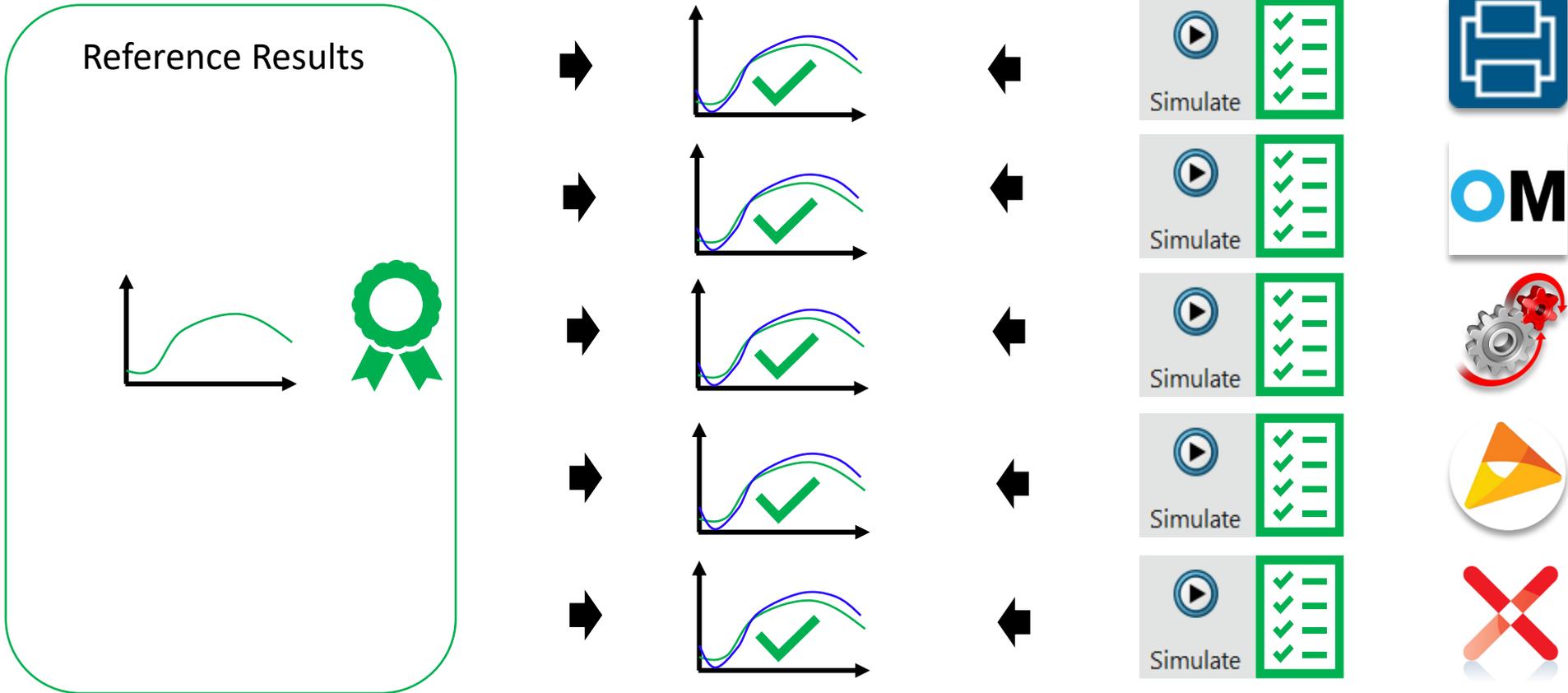
<https://www.wolfram.com/system-modeler/>

<https://modelon.com/modelon-impact/>

<https://www.keysight.com/cae/products/simulationx>

# Problem Specification

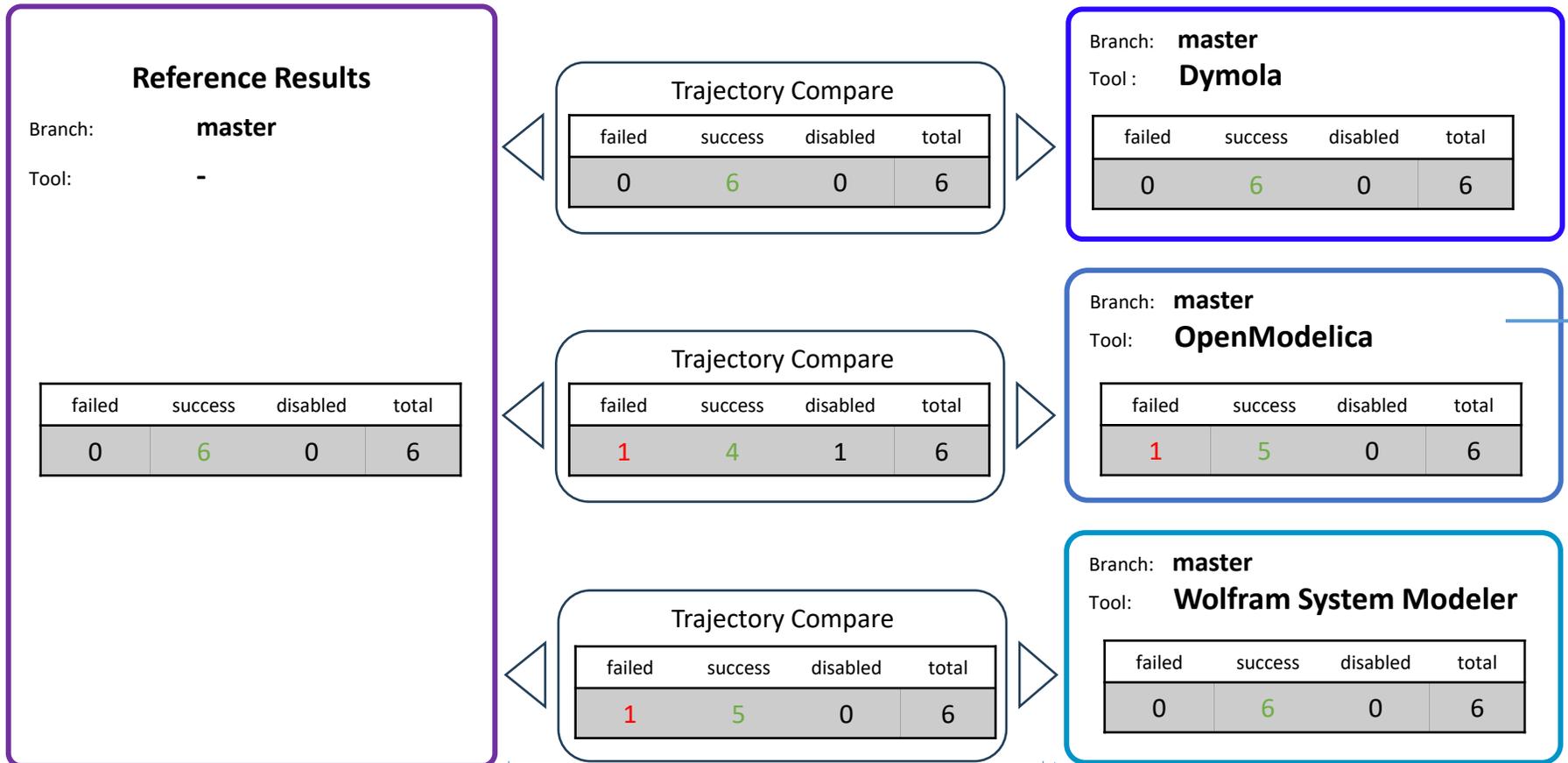
How Robert achieves this goal:



Every example must run successfully in each tool and the resulting trajectories must lay inside a tolerance around assessed reference trajectories

# Multi-tool regression tests on a single branch

overview page of ReSim



clicking the tile:  
see next slide

assessed reference trajectories

the resulting trajectories must lay inside a tolerance around assessed reference trajectories Every example must run successfully in each tool

# Multi-tool regression tests on a single branch

- clicking the single tiles leads to more detailed reports:

Testrun report

## 20260129081400

testing Simple Hydraulics Library with OpenModelica

**Summary**

SimpleHydraulics  
 Model path: C:\work\_MS\ReSim\SimpleHydraulics\package.mo  
 Git revision: N/A  
 Git url: N/A  
 Ran 6 testcases in 0:00:46

4 passed • 1 warned • 1 failed • 0 timed out • 0 unchanged by regression • 0 disabled

**Testsuite (6)**

Nr.	Name	Check	Translate	Simulate	Runtime
1	SimpleHydraulics.Examples.PumpCycle	0	0	1	0:00:13
2	SimpleHydraulics.Examples.ScalableHydraulics	0	0	1	0:00:15
3	SimpleHydraulics.Examples.TwoVolumes	0	0	1	0:00:11
4	SimpleHydraulics.Examples.TwoVolumes_CheckValve	0	0	2	0:00:10
5	SimpleHydraulics.Examples.HeatingSystem	2	0	None	0:00:20
6	SimpleHydraulics.Examples.ControlledPumpCycle	0	0	None	0:00:12

**Environment**

Simulator: OpenModelica v1.26.1 (64-bit)  
 Compiler: clang  
 OS: Windows 10.0.19041  
 User@Host: Matthias Schaefer@LTXMS20

[Show Setup Output](#) [Show flags](#)

**list of examples in the library**

**list of tasks performed for each example**  
 - can be adapted modularly - here:  
 Check - check equation balance  
 Translate - build/translate the model  
 Simulate - running /simulating the model  
green - everything worked  
yellow - everything worked but warnings occurred  
red - task failed

**general information**

**see next slide**

# Multi-tool regression tests on a single branch

- clicking on an example leads to a more detailed report:

Testrun report → Testcase report LTX

## 5 – SimpleHydraulics.Examples.HeatingSystem FAIL

20260129081400: testing Simple Hydraulics Library with OpenModelica

**Summary**

SimpleHydraulics.Examples.HeatingSystem  
C:\work\_MS\ReSim\SimpleHydraulics\package.mo

Ran 3 tasks in 0:00:20

Principal Errors : None

---

**Model info**

Name: SimpleHydraulics.Examples.HeatingSystem  
Integrator: Dassl  
Tolerance: 1.00e-06  
Intervals: 500  
Interval: 12.0

**Tasks**

**check** WARN

1.51 s	Task execution time
2	Warnings
0	Errors

[Open log](#)

**translate** WARN

10.2 s	Task execution time
1	Warnings <a href="#">link</a>
0	Errors
0	Numerical Jacobians
10	Continuous time states <a href="#">link</a>
2	Number NL equation systems
2	Largest NL equation system <a href="#">link</a>

[Open log](#)

**simulate** FAIL

8.65 s	Task execution time
None s	Simulation time
None	Time Events
None	State Events
None	Jacobian evaluations
None	Integrator Steps
None s	Total CPU time <a href="#">link</a>
None s	CPU time Integration
None s	CPU time Initialization

[Open log](#)

applied experiment settings e.g. from experiment annotation

numeric statistics for each tasks, e.g. a list of state variables and the log file coming directly from the tool

simulate - Open log

```

message stream="LOG_ASSERT" type="debug" text="residualFunction failed at time=0.
For more information please use -iv LOG_NS."
</message>
<message>
</message>
message stream="LOG_ASSERT" type="debug" text="Solving non-linear system 408 failed at time=0.
For more information please use -iv LOG_NS."
</message>
<message>
</message>
message stream="LOG_ASSERT" type="error" text="failed to solve the initialization problem with global hom
message stream="LOG_ASSERT" type="debug" text="unable to solve initialization problem."
</message>
message stream="LOG_ASSERT" type="info" text="simulation terminated by an assertion at initialization"

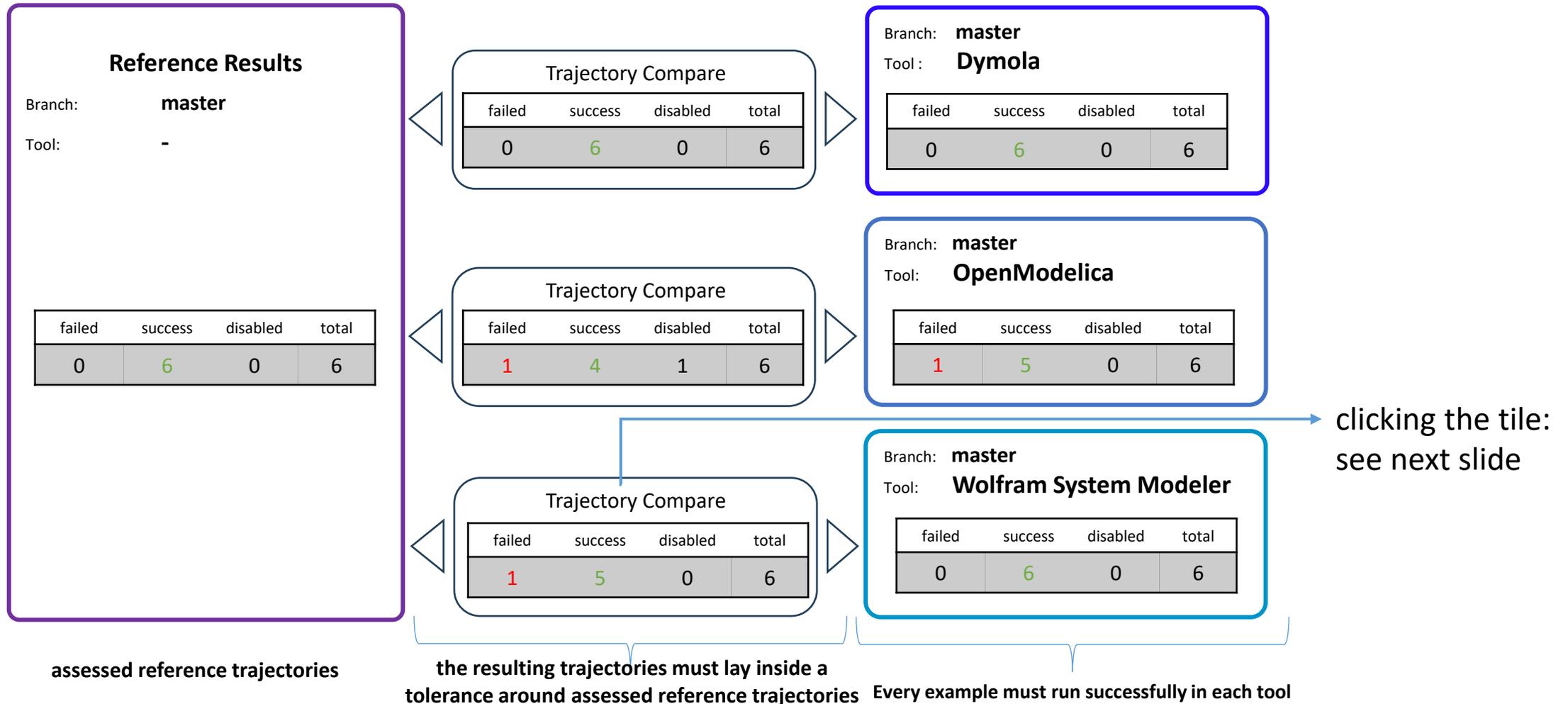
```

logFile from Modelica Tool

[Close](#)

# Multi-tool regression tests on a single branch

overview page of ReSim



# Multi-tool regression tests on a single branch

- Trajectory Comparison Tile

Testrun comparison



Testrun report

General Information											
Testrun ID		20260120082913				20260121080237					
Description		Reference Results				SimpleHydraulics with Wolfram System Modeler					
Testcase summary											
Differences in Tool and Tool Settings											
Differences in the library / package											
Testcases											
Nr.	Testcase Name	▲ CHK ⚙	TRN ⚙	SIM ⚙	DUR ⚙	CHK ⚙	TRN ⚙	SIM ⚙	DUR ⚙	VariableCompare ⚙	CSVCompare ⚙
1	SimpleHydraulics.Examples.PumpCycle	0	1	1	5.1 s	N/A	1	3	41.5 s	0 / 38	0 / 31
2	SimpleHydraulics.Examples.ScalableHydraulics	0	3	1	4.1 s	N/A	3	3	41.1 s	0 / 272	0 / 246
3	SimpleHydraulics.Examples.TwoVolumes	0	2	0	3.6 s	N/A	2	3	12.0 s	0 / 37	0 / 25
4	SimpleHydraulics.Examples.TwoVolumes_CheckValve	0	2	0	3.6 s	N/A	2	4	12.0 s	0 / 50	0 / 37
5	SimpleHydraulics.Examples.HeatingSystem	0	10	1	5.1 s	N/A	10	3	19.5 s	0 / 1407	0 / 910
6	SimpleHydraulics.Examples.ControlledPumpCycle	0	0	4	4.1 s	N/A	0	5	12.0 s	0 / 61	20 / 52

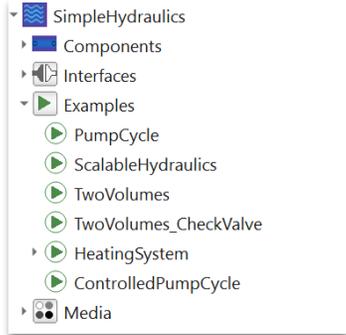
20 out of 52 trajectories failed (they are not inside the tolerance around the reference trajectory)

list of tasks performed for the [reference results](#) and their stati

list of tasks performed with a ModelicaTool (here: Wolfram System Modeler (WSM)) and their stati.  
The check task is deactivated here

list of comparison tasks performed to compare WSM results with the reference results:  
VariableCompare: comparing the names of the variables  
CSVCompare: comparing the trajectories with [csv-compare](#)  
- can be adapted modularly

# Timelaps



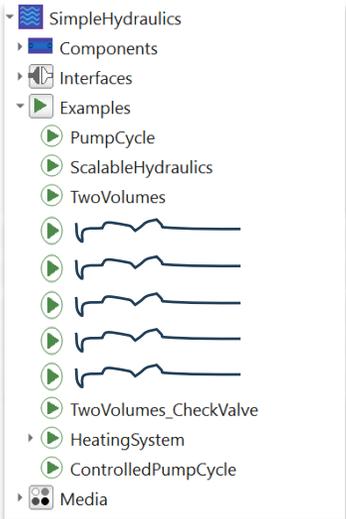
6 examples



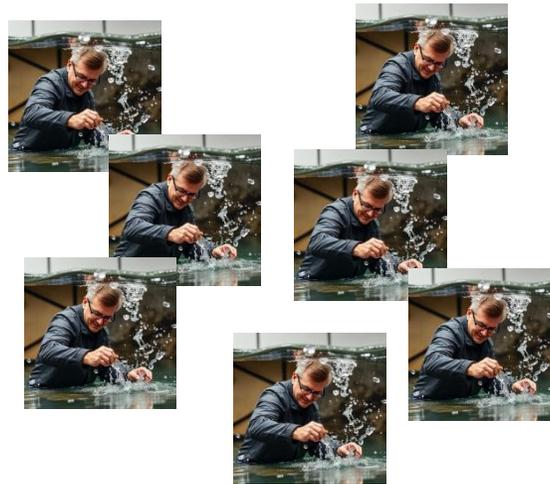
single developer



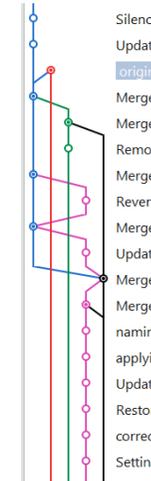
one branch



535 examples



team of developers



working with different branches and pull requests (PRs)

## Condition to allow merging

scenario: a whole team of developers working on different branches in git:

- Before merging a development branch (or PullRequest) into the master branch, it must be tested
- Usually a master branch isn't clean ("real world scenario")
- The status (# failed testcases and comparisons) **must not** deteriorate by merging

### example:

\*still failing is allowed:  
e.g. correction of typo  
in description will not  
change success of  
simulation

model name	master branch	develop branch /PR	Status Comparison
 SimpleHydraulics.A	✓	✓	still working
 SimpleHydraulics.B	✗	✗	still failing*
 SimpleHydraulics.C	✗	✓	improvement
 SimpleHydraulics.D	✓	✗	deterioration 

in total, we  
do **not**  
**allow** to  
merge this

# Condition to allow merging

overview for Pull Request Testing, this must be done for **each tool**:

**Reference Results**

Branch: **v4.1.0**

Tool: -

failed	success	disabled	total
0	535	0	535

**Trajectory Compare**

failed	success	disabled	total
2	533	0	535

**Status Compare**

deteriorated	improved	unchanged	not tested
6	0	214	315

**Trajectory Compare**

failed	success	disabled	total
8	212	315	535

Branch: **master**

Tool: **Dymola**

failed	success	disabled	total
0	535	0	535

**Status Compare**

deteriorated	improved	unchanged	not tested
0	0	220	315

Branch: **PR #4707**

Tool: **Dymola**

failed	success	disabled	total
0	220	315	535

all examples running in the master branch are also running in the PullRequest (PR)

In this case the trajectories of 6 examples of the PR lay outside the tolerance around the reference trajectories, which were inside before (in the master branch), so **merging can not be allowed** in this case -> see next slide

Only models effected by the commit were tested (getting effected models by analysis of the class structure of the Modelica package)

# Condition to allow merging

## Status Comparison Report

compare master branch with reference results    compare pull request with reference results

Testrun comparison		compare master branch with reference results		compare pull request with reference results				
<b>General Information</b>								
Testrun ID	MAP-LIB_ReferenceResults	20260121142811	20260122105036		✘			
Description	MAP LIB Reference Results	Modelica (master) with OpenModelica	Pull Request					
<b>Testcase summary</b>								
<b>Differences in Tool and Tool Settings</b>								
<b>Differences in the library / package</b>								
<b>Testcases</b>								
Nr.	Testcase Name	Status	VariableCompare	CSVCompare	Status	VariableCompare	CSVCompare	Status Comparison
244	Modelica.Electrical.PowerConverters.Examples.Transformer_T	5	N/A	0 / 4	N/A	N/A	N/A	remain successful
245	Modelica.Electrical.PowerConverters.Examples.ACAC.Dimmer_R	400	N/A	0 / 11	N/A	0 / 11	0 / 11	remain successful
246	Modelica.Electrical.PowerConverters.Examples.ACAC.Dimmer_RL	400	N/A	0 / 11	1 / 11	0 / 11	1 / 11	still failing
247	Modelica.Electrical.PowerConverters.Examples.ACAC.SoftStarter	800	N/A	0 / 23	N/A	0 / 23	2 / 23	deteriorated
248	Modelica.Electrical.PowerConverters.Examples.ACDC.Rectifier1Pulse.Thyristor1Pulse_R	5	N/A	0 / 9	N/A	0 / 9	0 / 9	remain successful
249	Modelica.Electrical.PowerConverters.Examples.ACDC.Rectifier1Pulse.Thyristor1Pulse_R_Characteristic	500	N/A	0 / 9	N/A	0 / 9	0 / 9	remain successful
250	Modelica.Electrical.PowerConverters.Examples.ACDC.RectifierBridge2mPulse.DiodeBridge2mPulse	30	N/A	0 / 6	N/A	0 / 6	0 / 6	remain successful

check whether the status has changed between these two trajectory comparisons

- remain successful - successful trajectory comparison in both cases
- improved - PR made trajectory comparison to succeed (not in picture)
- still failing - failing trajectory comparison in both cases ==> **this is allowed !**
- deteriorated - PR made trajectory comparison to fail ==> **not allowed !**

## Summary: Benefits of Resim

- Specialized for Modelica Libraries
- **Supports multiple Modelica Tools** (Dymola, OM, ModelonImpact, WSM) and FMUs (FMPy)
- creates html reports
  - with model statistics (like algebraic loops, #events, ...)
  - with **all tool/experiment/... settings to reproduce the simulation**
- no specific preparation of the model necessary (like defining reference signals,...)
- **Modular Structure:** Many optional tasks available
  - For running examples: Check, Translate, Simulate, ...
  - For comparing results: VariableCompare, CSVCompare, ...
- CPU/RAM Surveillance
- Also suited for testing tool version changes, performance comparison, ...



## Conclusion: Project Status of ReSim

- ReSim is still under development
  - Not yet a product "ready to use"
- testing as a service
  - > please ask us !
- In future:
  - experimental / guided usage

# Thank you for your attention !

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work was performed in the [OpenScaling Project](#)

