

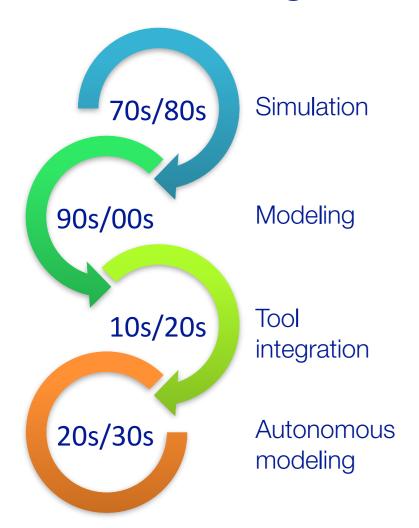
BIM/GIS and Modelica Framework for building and community energy system design and operation

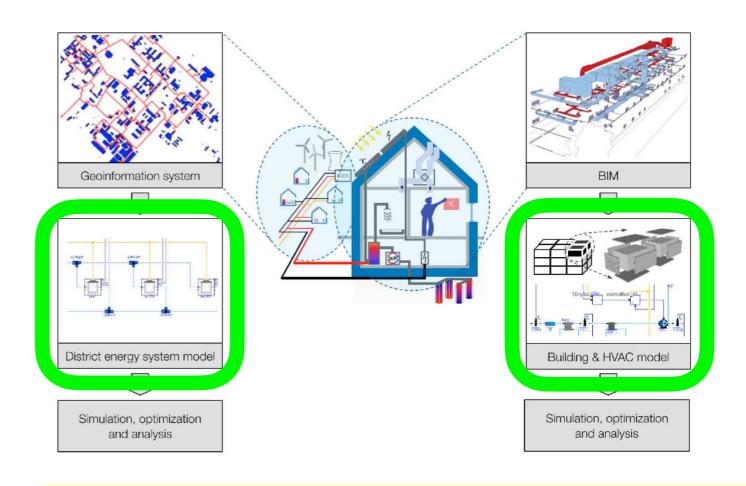
WP 1.1- Modelica Library for Design and Operation

October 13, 2020

Michael Wetter

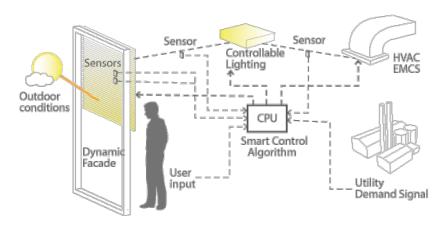
Work Package 1.1 Goal

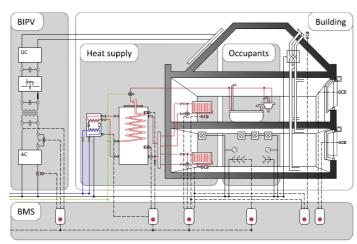


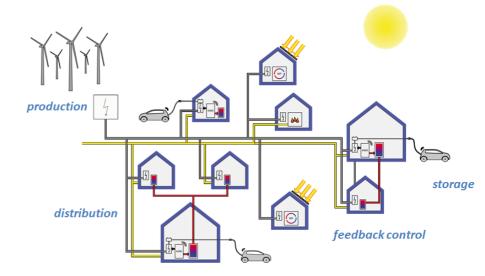


Develop Modelica library applicable for systemlevel autonomous modeling.

- validated
- well documented
- state-of-the-art physics and dynamics







From controls

to

buildings

and communities

Progress in last half year - Modelica IBPSA Library

18 pull requests have been merged to the master

Airflow

- Cleaned up implementation to remove parameter that are no longer used https://github.com/ibpsa/modelica-ibpsa/issues/1362
- In progress: More efficient door model <u>https://github.com/ibpsa/modelica-ibpsa/issues/1353</u>

Boundary Conditions

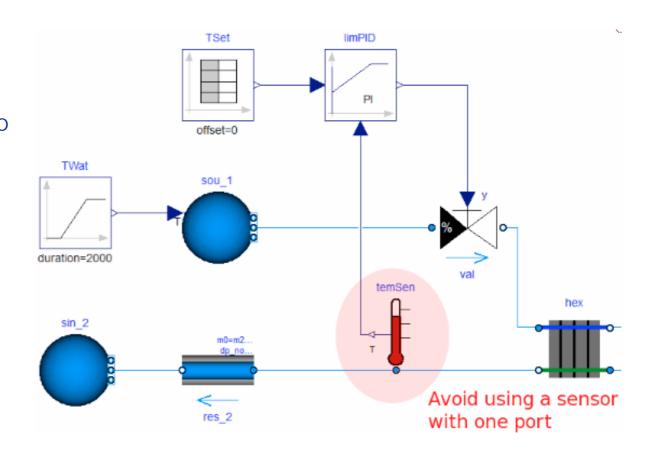
 In progress: New BESTEST for weather data processing https://github.com/ibpsa/modelica-ibpsa/issues/1314

Fluid

- Warning for one-port sensor https://github.com/ibpsa/modelica-ibpsa/issues/1399
- Improvement to valves to avoid division by zero warning https://github.com/ibpsa/modelica-ibpsa/issues/1376
- In progress: Partially wet coil https://github.com/ibpsa/modelica-ibpsa/issues/1109

Controls

 Corrected definition of reverse action https://github.com/ibpsa/modelica-ibpsa/issues/1365



Media

- In progress:
 - Implementation of R134a, R290, R410A, R744, and R32 https://github.com/ibpsa/modelica-ibpsa/issues/1093
 - Implementation of steam https://github.com/ibpsa/modelica-ibpsa/issues/1389

General

Tested with MSL 4.0.0 and with Dymola 2021

Progress in last half year - BuildingsPy

12 pull requests have been merged to the master

Version 2.1.0 released on May 28, 2020

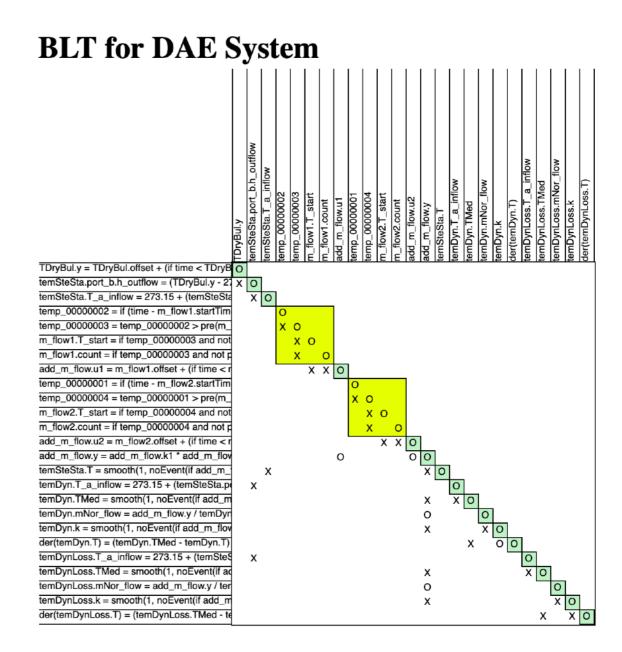
Added check for wrong derivative implementation that is reported by Dymola 2021x https://github.com/lbl-srg/BuildingsPy/issues/376

Refactored buildingspy.simulate.Dymola, and added buildingspy.simulate.Optimica.

Same API for Dymola and Optimica/JModelica. https://github.com/lbl-srg/BuildingsPy/issues/354

from buildingspy.simulate.Optimica import Simulator
s=Simulator("IBPSA.Fluid.Sensors.Examples.
 TemperatureDryBulb")

- s.addParameters({'TDryBul.height': 20})
- s.setResultFilter(['*T'])
- s.generateHtmlDiagnostics()
- s.simulate()



Updates from user-facing libraries

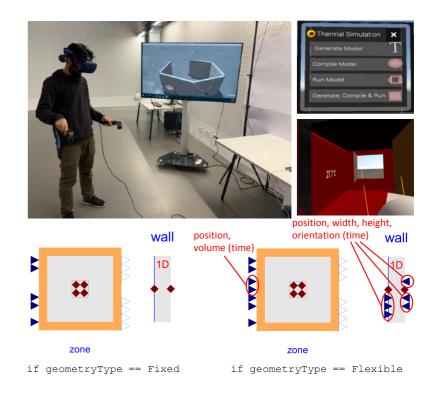
BuildingSystems

Virtual Reality building energy simulation environment

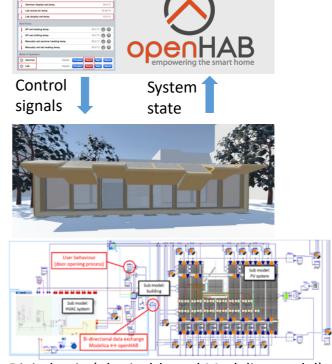
- Defining building models and performing simulation experiments within an interactive VR environment
- Flexible component and room geometry during runtime (models for walls, windows, doors, zones)
- Real time data exchange between the VR environment and the Modelica building models

Coupling of BuildingSystems library with openHAB

- Coupling of Modelica models with building automation software openHAB (https://www.openhab.org)
- SIL (e.g. model based evaluation of control strategies) and HIL (e.g. model based control of real devices) simulations scenarios



Control strategy (evaluation)



Digital twin (physical-based Modelica model) of the real energy building system

Buildings

OpenBuildingControl

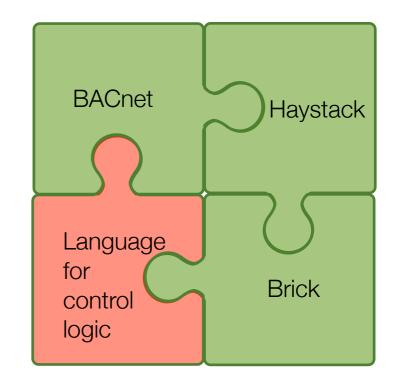
- ASHRAE Standard 231P (Control Description Language) started.
- In progress: Update of control sequences for
 - VAV (ASHRAE Guideline 36)
 - boiler & chiller plants (ASHRAE RP 1711)
 - radiant systems

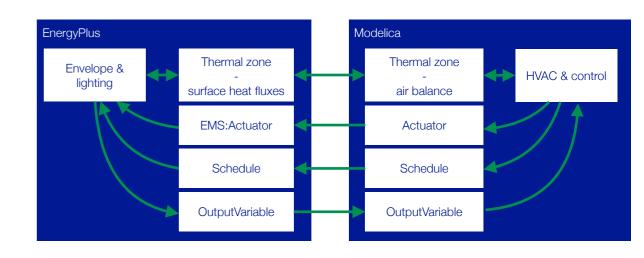
Spawn of EnergyPlus (branch issue1129_energyPlus_zone)

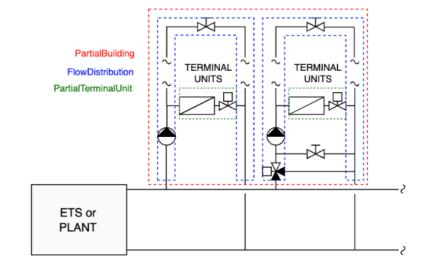
- Release planed for fall 2020
- Can model multiple buildings, read E+ output variables to Modelica, write to schedules and actuators
- Next year: Adding radiant systems

District heating and cooling

- Engine for URBANopt
- Templates for 5th generation DHC







IDEAS



OpenIDEAS

An open framework for integrated building and district energy simulations

Stable, focus on maintenance

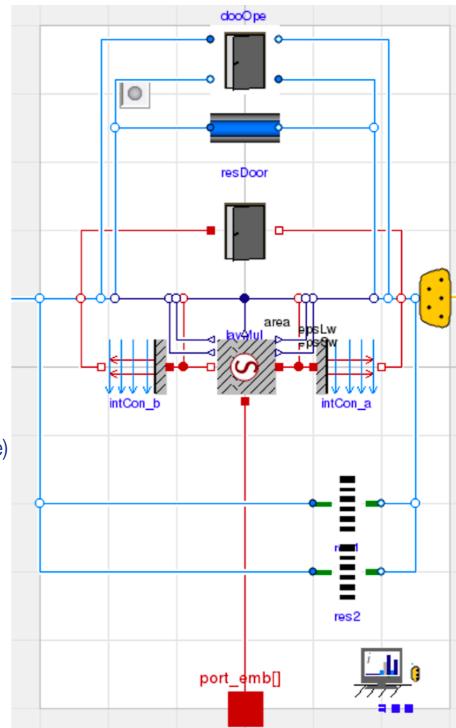
Features and upgrades since May:

- BOPTEST simple hydronic case added (WP 1.2)
- Documentation and usability improvements
- IBPSA merge
- Updated unit tests to python 3.6

Fan coil unit model & condensing heat exchanger (collaboration LBL)

Pressure-driven interzonal airflow (collaboration UGent)

- Features:
 - Integration into IDEAS.Buildings.Components (done)
 - Cracks, leakage coefficients automatically computed from n50 (done)
 - External wind pressure (done)
 - Coupled to HVAC (done)
 - Stack effect (todo)
- Comparison CONTAM: good preliminary results
- Abstract BS2021 accepted



AixLib v0.9.1

Current status - AixLib

- Much work done on continuous integration (CI) for AixLib repos
- Using GitLab CI and OpenStack Applications
- Cl jobs for: HTML-Check, Check/Simulate, Regression Test, Merge Check, Style Check

Next steps

- Modelica fmi
- Automatic IBPSA merge
- Night build

Lab-Space in the VR-Lab Lab:

https://github.com/RWTH-EBC/ VR Homepage Integration

