

Reporting of BOPTEST test cases

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Expert meeting
October 13, 2020



REPORTING OF TEST CASES

- **Motivation:** Conclusions in building control are extremely **case-sensitive**. Only statistics could serve as a decision-tree for future optimal control development guidelines
- **Concept:**
 - Spreadsheet:
 - Share initial results
 - Identify test case features
 - Official reporting interface:
 - Systematically store solutions
 - Display results in a comprehensible manner

BOPTREE SPREADSHEET

- Transition: from first results to official public reporting
- Essentially same objective as final interface
- Lean prototype for:
 - Sharing first results
 - Identify key test case features
 - Enable clean interface development
- <https://docs.google.com/spreadsheets/d/1E-5wR7nasW8h6kEtrXnUzcRrEA6f7TlxjbtSdB1Cz3w/edit?usp=sharing>

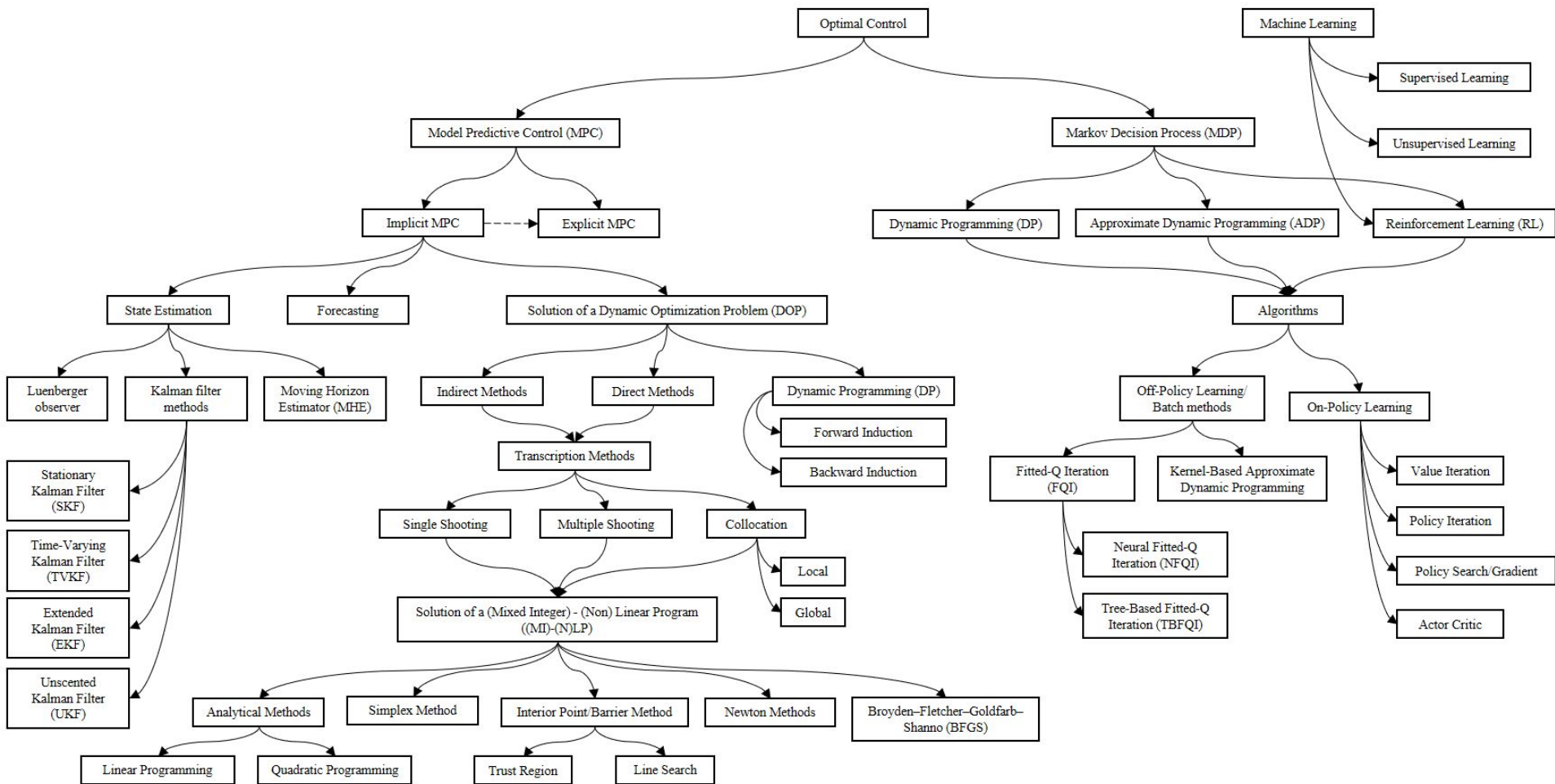


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Label	StartTime	StopTime	AvgTe	AvgTi	AvgIrr	PeakIrr	BuiSize	HVACType	ModType	Step	Horizon	nStates	tdis_tot	cost_tot
2	a678d6d	0	904672	275.36	295.87	133.75	374.28	653	Water	Grey	900	86400	23	7.52	236.54
3	48fd879	806500	1004672	278.45	296.79	150.43	483.15	1576	Water	White	3600	21600	274	2.43	1837.95
4	a978d78	709000	4004672	265.36	294.46	89.87	374.28	2757	Air	White	900	10800	586	1.53	1342.56
5	lj870d98	0	904672	288.94	297.37	202.45	457.98	1809	Air	None	300	10800	0	14.7	236.54
6	56q7k67	478900	5609400	279.12	296.15	180.36	356.98	923	Water	Black	1800	86400	23	8.64	236.54

DEPLOYED TEST CASE DEFINITION

- **KEY: TRADE-OFF BETWEEN**
 - ACCURACY → to define a deployed test case
 - SIMPLICITY →
 - Controller: to facilitate users to characterize their controllers
 - Test case: to populate data and enable comparison
- **DEPLOYED TEST CASE = CONTROLLER + TEST CASE**
 - CONTROLLER DEFINITION
 - Aggregation of several features → discussion on which ones is coming right after this slide
 - TEST CASE DEFINITION
 - Building type
 - Parameters
 - Electricity price scenario → constant, dynamic, highly dynamic
 - Weather forecast uncertainty → discussion on this one coming later
 - Test time period


CONTROLLER DEFINITION



TEST CASE DEFINITION

- **BUILDING TYPE**
 - One of the “IBPSA 12”
- **PARAMETERS**
 - **Electricity Price Scenario**
 - Constant
 - Dynamic
 - Highly Dynamic
 - **Weather Forecast Uncertainty Scenario**
 - To-Be Discussed
 - **Time period**
 - Propose: “Summer”, “Winter”, “Shoulder”
 - Potentially: Annual
 - In development: Representative Days

GRAPHICAL USER INTERFACE



OBJECTIVELY AND QUANTITATIVELY EVALUATE BUILDING CONTROL ALGORITHMS

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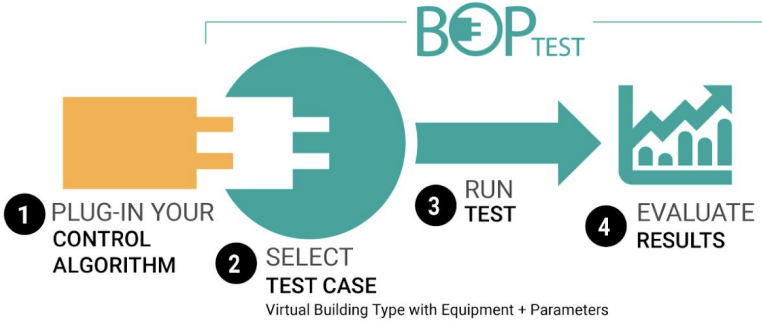
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1 PLUG-IN YOUR CONTROL ALGORITHM

2 SELECT TEST CASE
Virtual Building Type with Equipment + Parameters

3 RUN TEST

4 EVALUATE RESULTS

Note: If they rollover, Click to see details

CONTROLS ALGORITHM

The need for advanced control strategies (ACS) in buildings is growing due to emerging objectives to reduce energy consumption, integrate with electric power grid, integrate with district thermal networks, and improve responsiveness and service to occupants.

Get Started By Reviewing the Documentation >

VIRTUAL BUILDINGS/ EQUIPMENT

The BOPTTEST (Building Operation TESTing) Framework consists of a set of Modelica models that represent different buildings with different HVAC systems in different climate zones. BOPTTEST exposes the "control points" of these models using a standard, familiar API that allows control algorithms to interact with the models as if they are physical buildings. The BOPTTEST Framework also includes standardized key performance indicators (KPI) and reports and infrastructure for simulation-based comparison, benchmarking, and debugging of ACS.

RESULTS

BOPTTEST is an open and level playing field on which different control algorithms can be quantitatively benchmarked and compared. In addition, it is a virtual environment field that supports meaningful experiments with control algorithms without the need for physical installations in existing buildings.

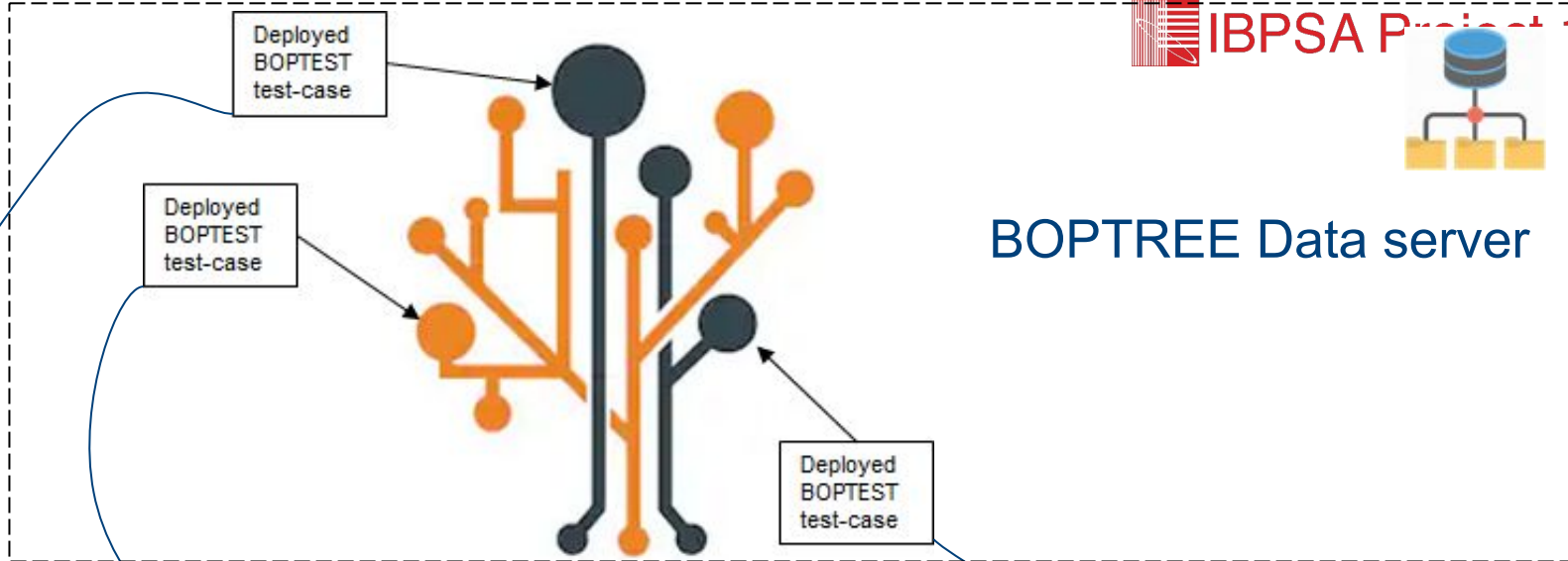
LATEST TEST RESULTS

User	Building Type	Total Energy [kWh]
	Name of building type here and It could wrap if that would work	23.04
	Name of building type here and It could wrap if that would work	13.25
	Name of building type here and It could wrap if that would work	15.67
	Name of building type here and It could wrap if that would work	18.3
	Name of building type here and It could wrap if that would work	11.01
	Name of building type here and It could wrap if that would work	19.46
	Name of building type here and It could wrap if that would work	10.15
	Name of building type here and It could wrap if that would work	11.30
	Name of building type here and It could wrap if that would work	14.37
	Name of building type here and It could wrap if that would work	13.31
	Name of building type here and It could wrap if that would work	24.7

View All Shared Test Results >

DISCUSSION

BOPTREE Data server



The “Leaves” of the tree are populated with deployed BOPTEST test-cases worldwide

Building Optimization Performance Tree (BOPTREE)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
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- **Boundary condition variables**: Average outdoor temperature, average irradiation, peak irradiation...
- **Building description variables**: Size, HVAC type...
- **Control variables**: Type of controller, type of model, objective function, prediction horizon, control time step...
- **References**: author contact, associated publication (if any)...
- **Results**: (=core KPIs) thermal discomfort, total operational cost...

Building Optimization Performance Tree (BOPTREE)

- Many technical challenges arise:
 - Some data can be retrieved directly from the BOPTEST test-case, but some is to be specified by the controller developer. How this data is collected and reported?
 - How to authenticate results?
 - Where to store the data?
 - Who can have access to it? how?