Advanced Battery Management System – DE-AR0000278

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Research and Technology Center North America

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Advanced Battery Management Systems (ABMS)

ABMS

Robert Bosch LLC
Corporate Research North America

Nalin Chaturvedi – PI
Jake Christensen – Co-PI

Tasks: battery/aging models, control algorithms, SW dev., advanced BMS SW

Cobasys*

Jacob Bemrich – Co-PI

Tasks: Battery pack build-up, reference battery, test/validation

UC San Diego

Miroslav Krstic – Co-PI

Tasks: PDE# estimation and control theory for battery systems

***Wholly owned subsidiary of Robert Bosch LLC;**
#PDE – Partial Differential Equations

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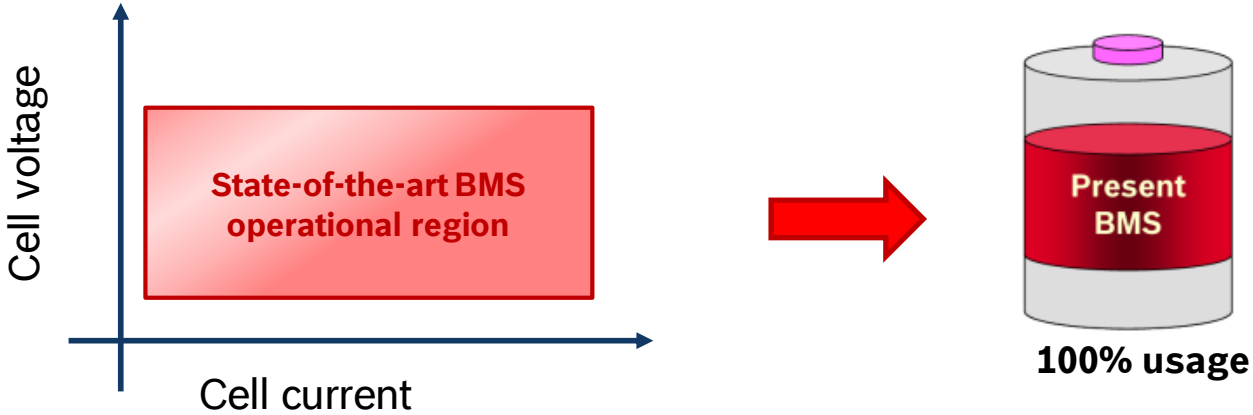
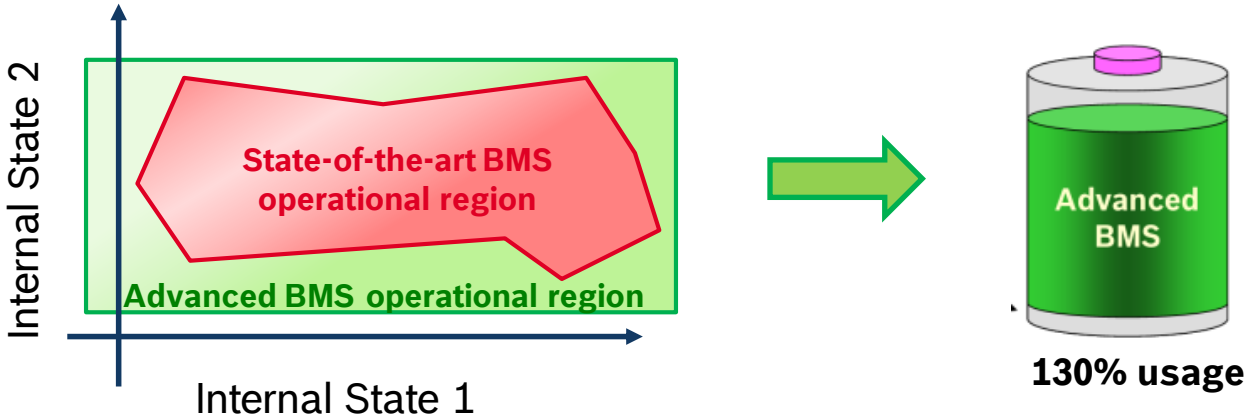
Advanced BMS SW: Key innovation

State-of-the-art



Bosch innovation



http://arpa-e.energy.gov/?q=arpa-e-projects/battery-management-and-control-software

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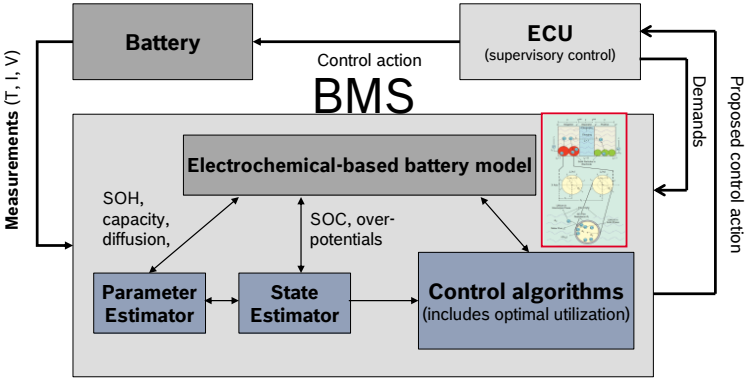
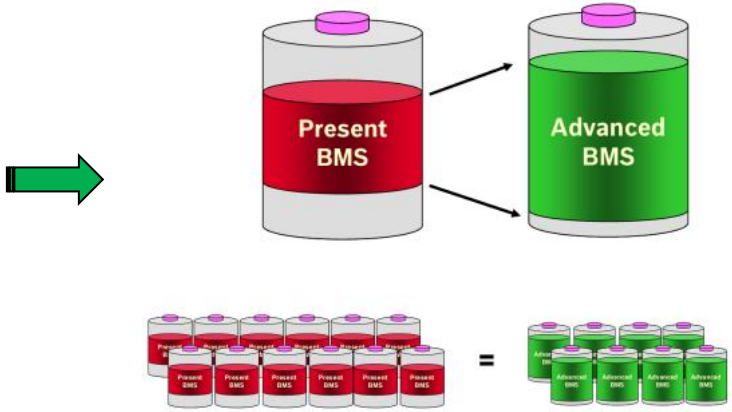
Benefits of ABMS

Advanced BMS



Available capacity



Performance Benefits

- Reduce cost of batteries > 25% by increasing the envelope of battery operation
- Reduce charge time by more than 50%, enable higher penetration of EVs

Performance Targets

Metric	State of the Art	Proposed
Cost of battery pack	$10,000	$7,500
Charge time from 0% to 80% capacity	30 min to 3 hrs	< 15 min
Available capacity	100%	125% – 133%

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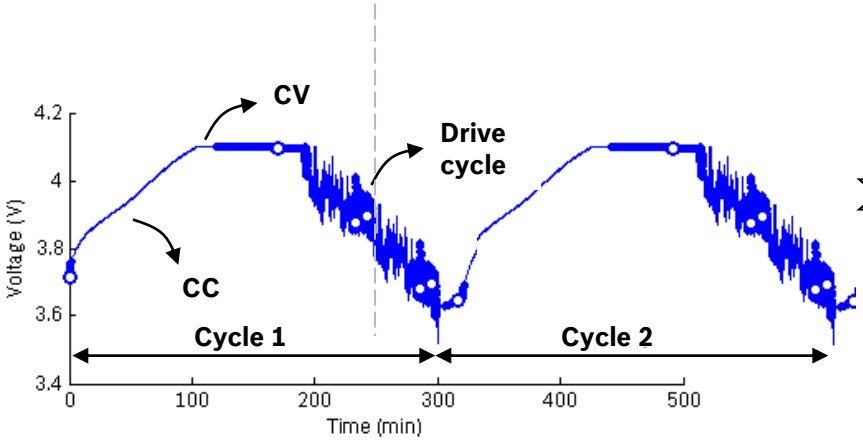
Validation Plan

Test 1: Standard-BMS

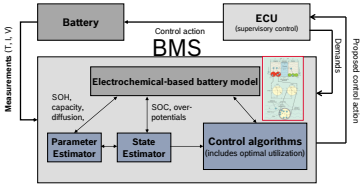
Larger Pack

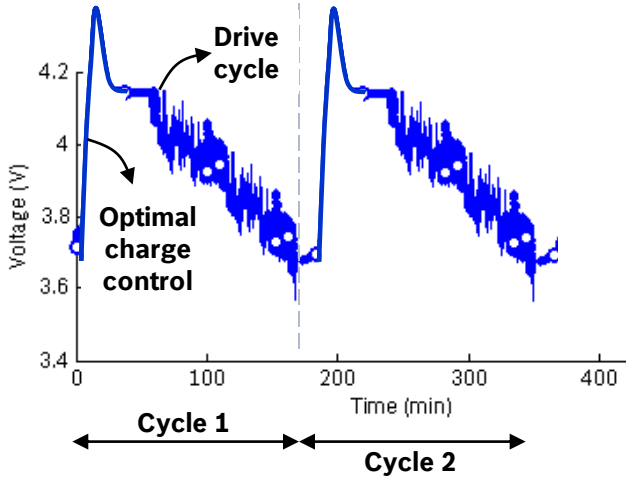


≈ N* cycles

Smaller Pack

Test 2: Advanced-BMS





≈ N* cycles

*N = Battery cycle life

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Project Kickoff in 03/2013; work focus in 2013 on extraction of elchem parameters and model reduction

Develop methods for extraction of el.chem param.

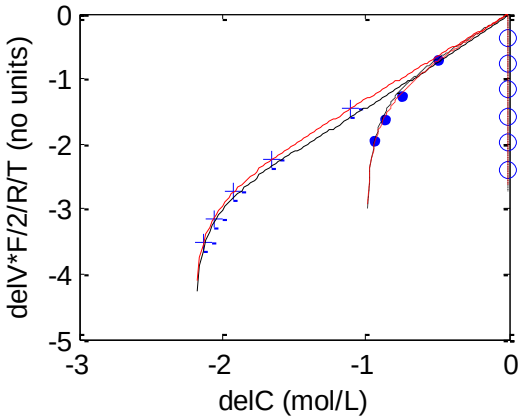
- Solid-phase properties (OCP[1], vol. frac., diff.)
- Elyte properties (cond., diffusion, transf. no., activity coeffs.)

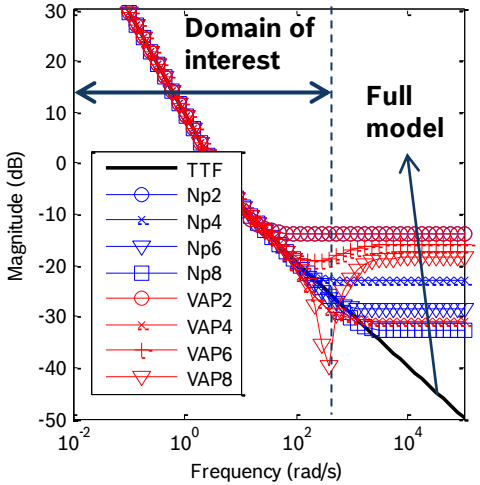
Develop model reduction theory for el.chem models

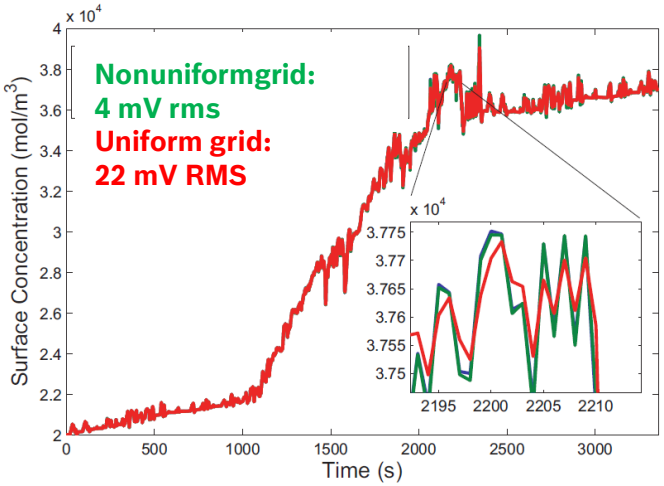
- Model reduction technique based on projection theory
- Theory tested and validated on PDE[2]

Develop detailed el.chem truth model for baseline cells

- Detailed electrochemical truth model for Li-ion cells
- Enhancements to el.chem model provide improved accuracy







1: OCP – Open circuit Potential; 2:PDE – Partial Differential Equations

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