

EVS26

GRANDES MENTES PENSAM ELETRICAMENTE
LAS MENTES BRILLANTES TIENEN IDEAS ELÉCTRICAS
GREAT MINDS THINK ELECTRIC
LES GRANDS ESPRITS S'ILLUMINENT
AGAR BUDDHIMAN HO BIJLI YAAD KARO
GROTE GEESTEN ZIJN VERLICHT KLUGE KÖPFE DENKEN ELETRISCH

26th International Electric Vehicle Symposium

Development of a Thermal Model for Lithium-Ion Batteries for Plug-In Hybrid Electric Vehicles

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IN COLLABORATION WITH

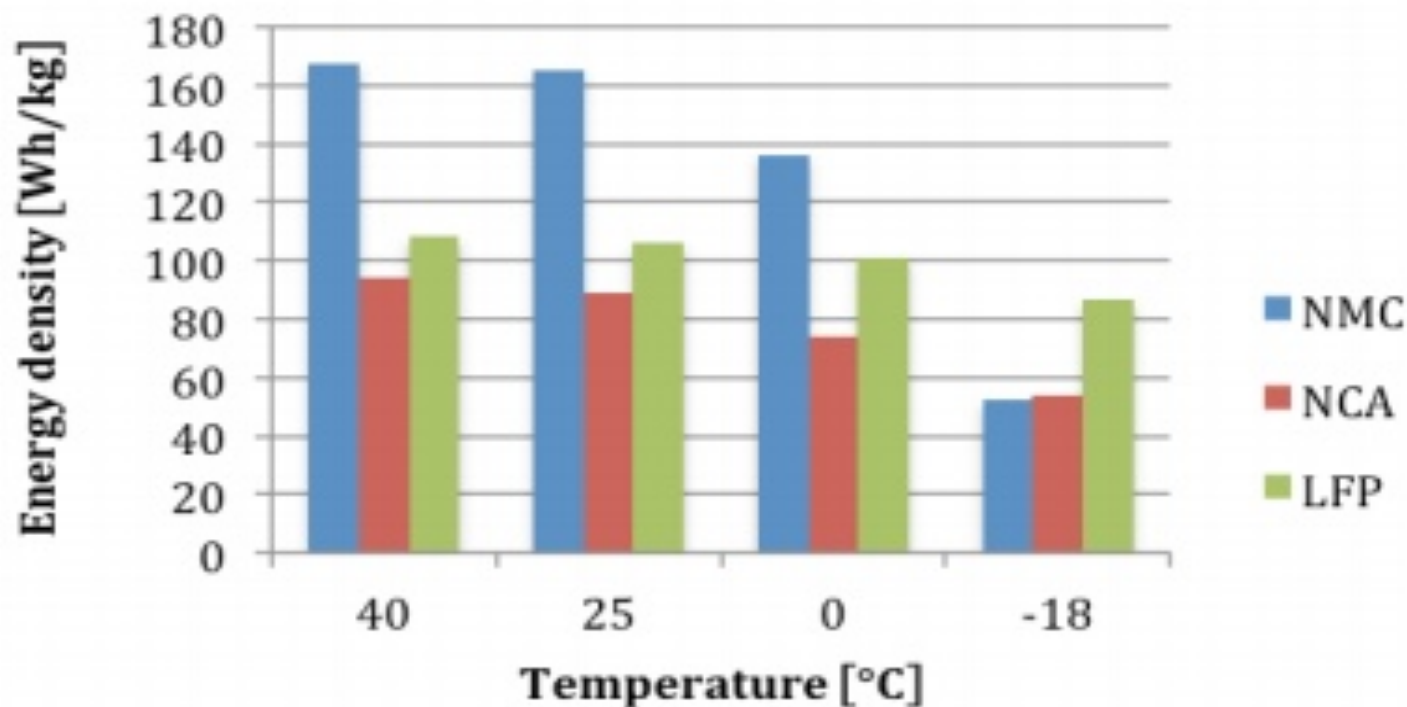


- Plug-in hybrid electric vehicles have received considerable attention due to:
 - Reduce gasoline consumption
 - Decrease green house gas emissions



- Power requirements
- Energy performances
- Wide SoC range (100 – 20%)
- High rate capabilities
- Long cycle life
- Good **thermal stability/behaviour**

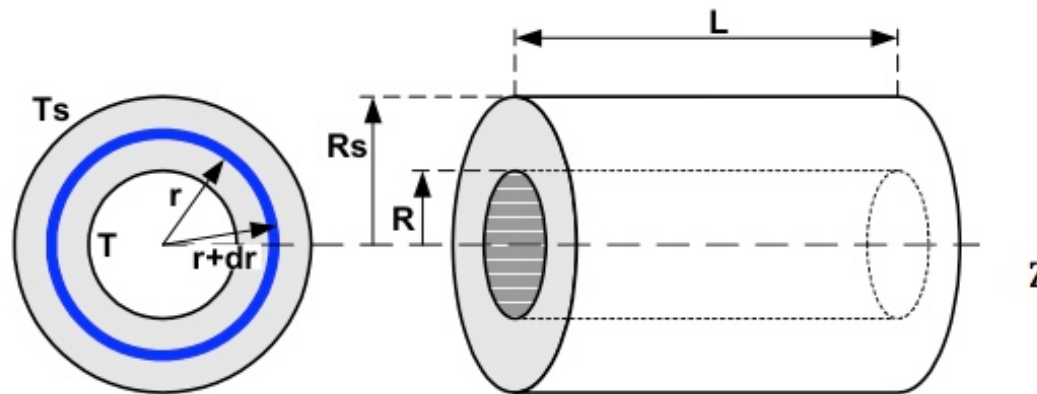
Temperature impact



- Thermal sensors
 - More than one sensor is required
- Surface thermal sensors
 - Expensive
- Thermal models
 - 3D models
 - Complicated
 - Difficult to implement in PHEVs
 - 1D models
 - More suitable to implement

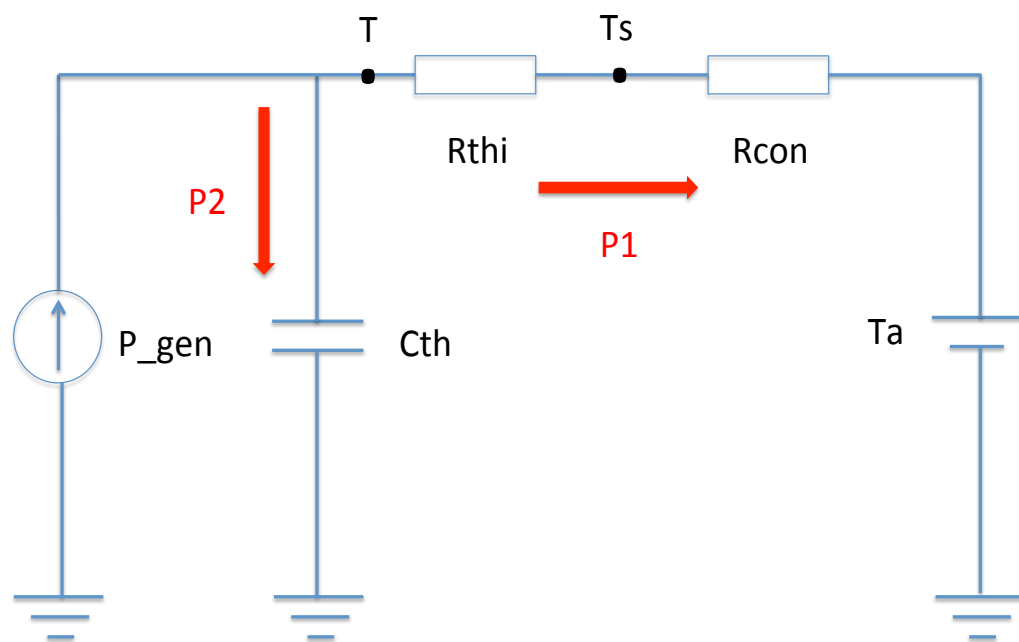
■ Heat equation in cylindrical coordinates:

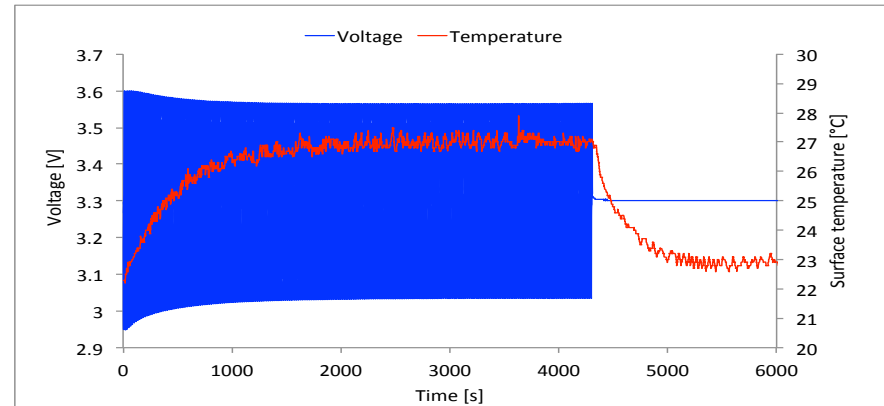
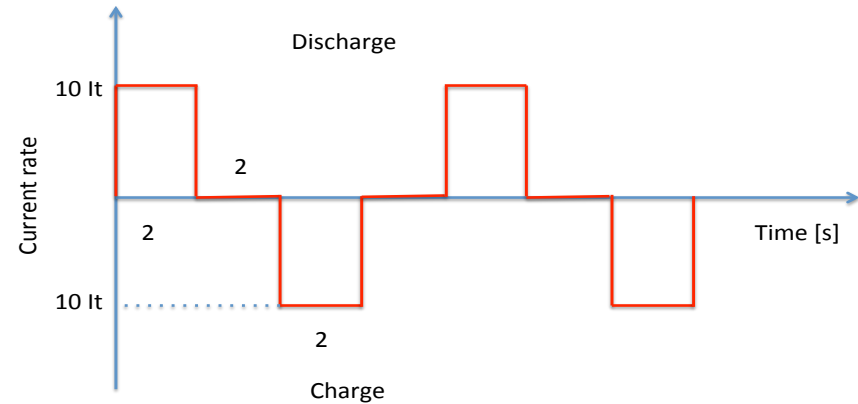
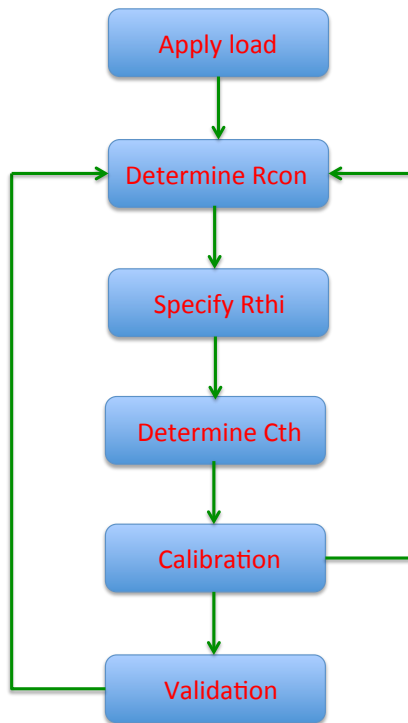
$$\frac{1}{r} \frac{\partial}{\partial r} \left(r k_r \frac{\partial T}{\partial r} \right) + \frac{\partial}{\partial z} \left(k_z \frac{\partial T}{\partial z} \right) + \frac{I}{V} \left((E - U) - \left(T \frac{dE}{dT} \right) \right) = \rho C_p \frac{\partial T}{\partial t}$$



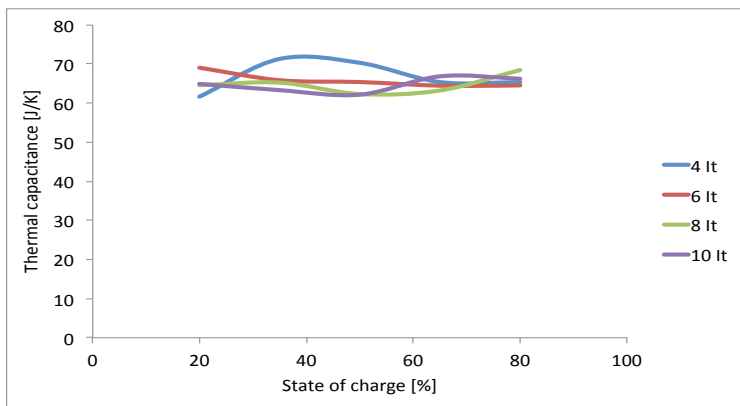
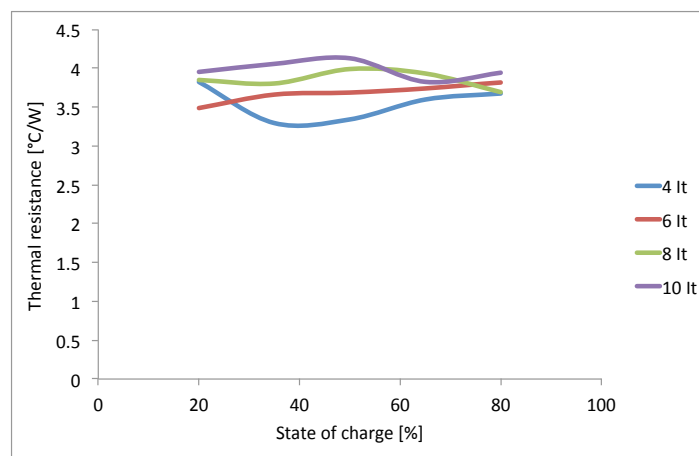
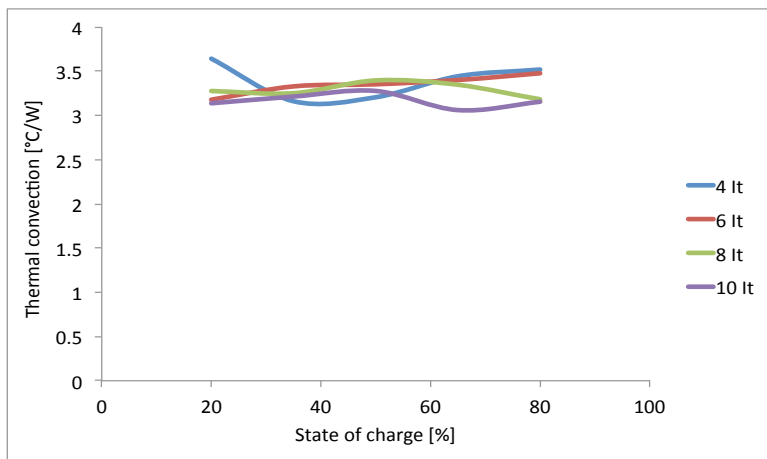
- Thermo-electrical analogon:

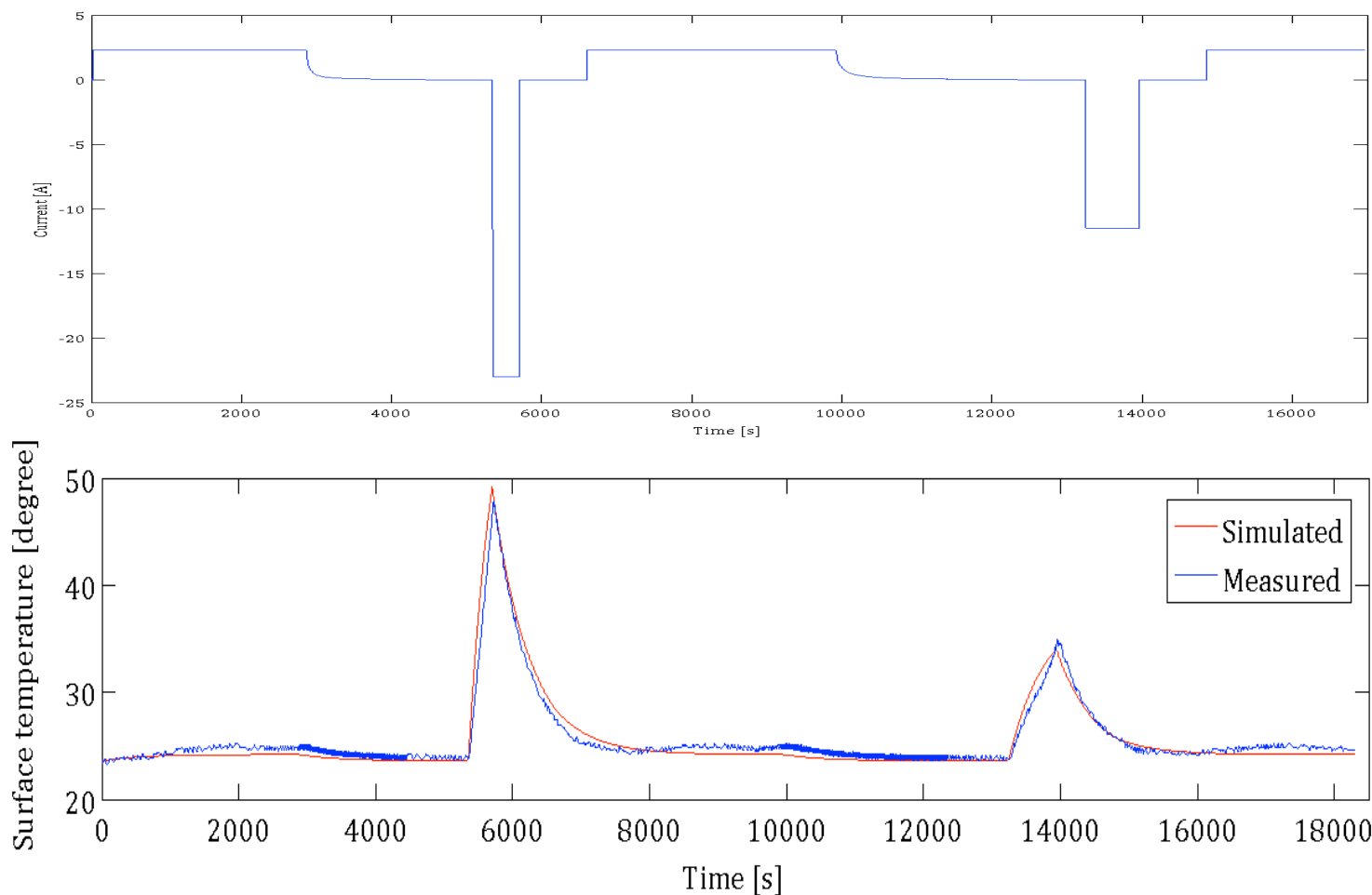
- Heat generation
- Thermal resistance
- Thermal capacitance
- Thermal resistance
- Ambient temperature

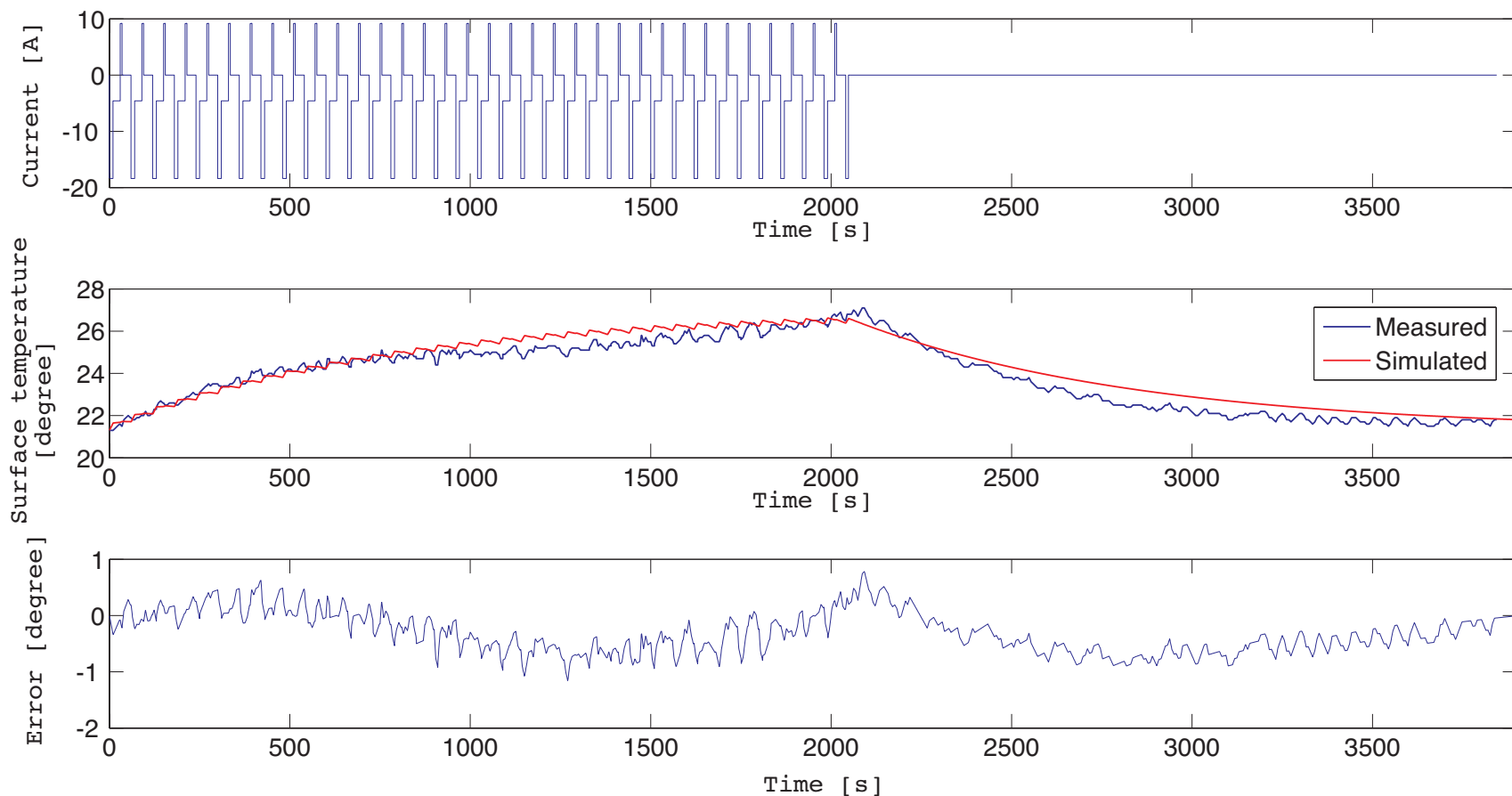




Parameter dependency







- New thermal model
- Based on electrical components
- High accuracy (+/- 2°C)
- Implementation in BMS is possible

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- The MOBI research group at VUB-ETEC
- *Research infrastructure co-funded by the European Fund for Regional Development*



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