

HTAS Electric Vehicle Technology

Control of electric powertrain and vehicle systems

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TNO | Kennis voor zaken



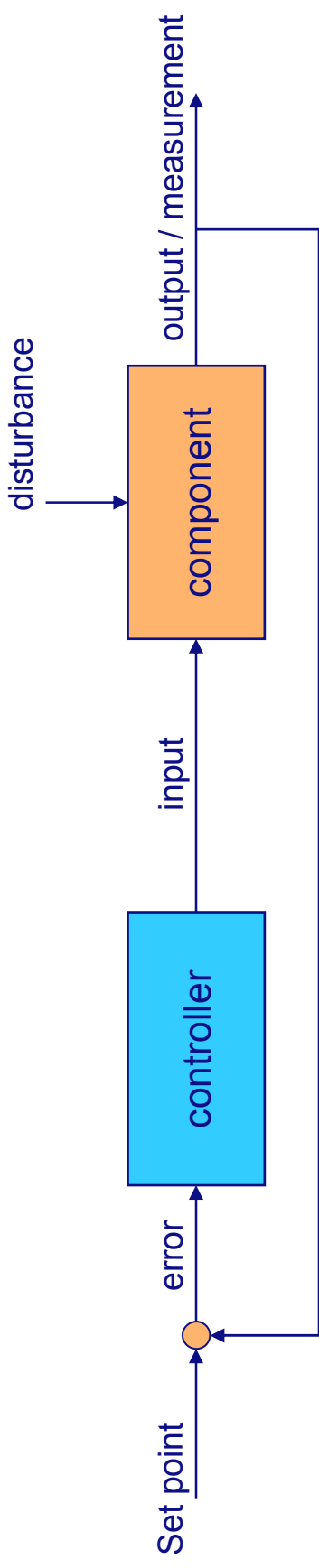
Outline

- Component control / system control / powertrain control
- Increasing (control) system complexity
- Supervisory control objectives
- Extending the electric range / eRange prediction & control
- Required developments

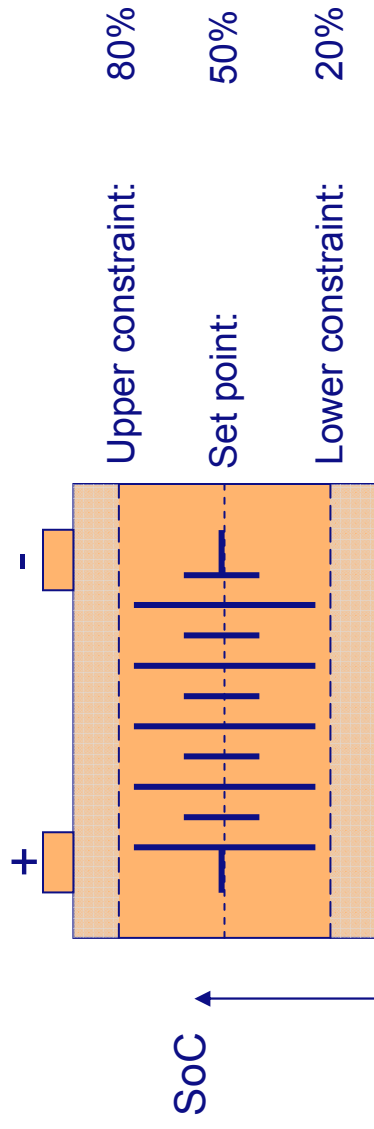


Control

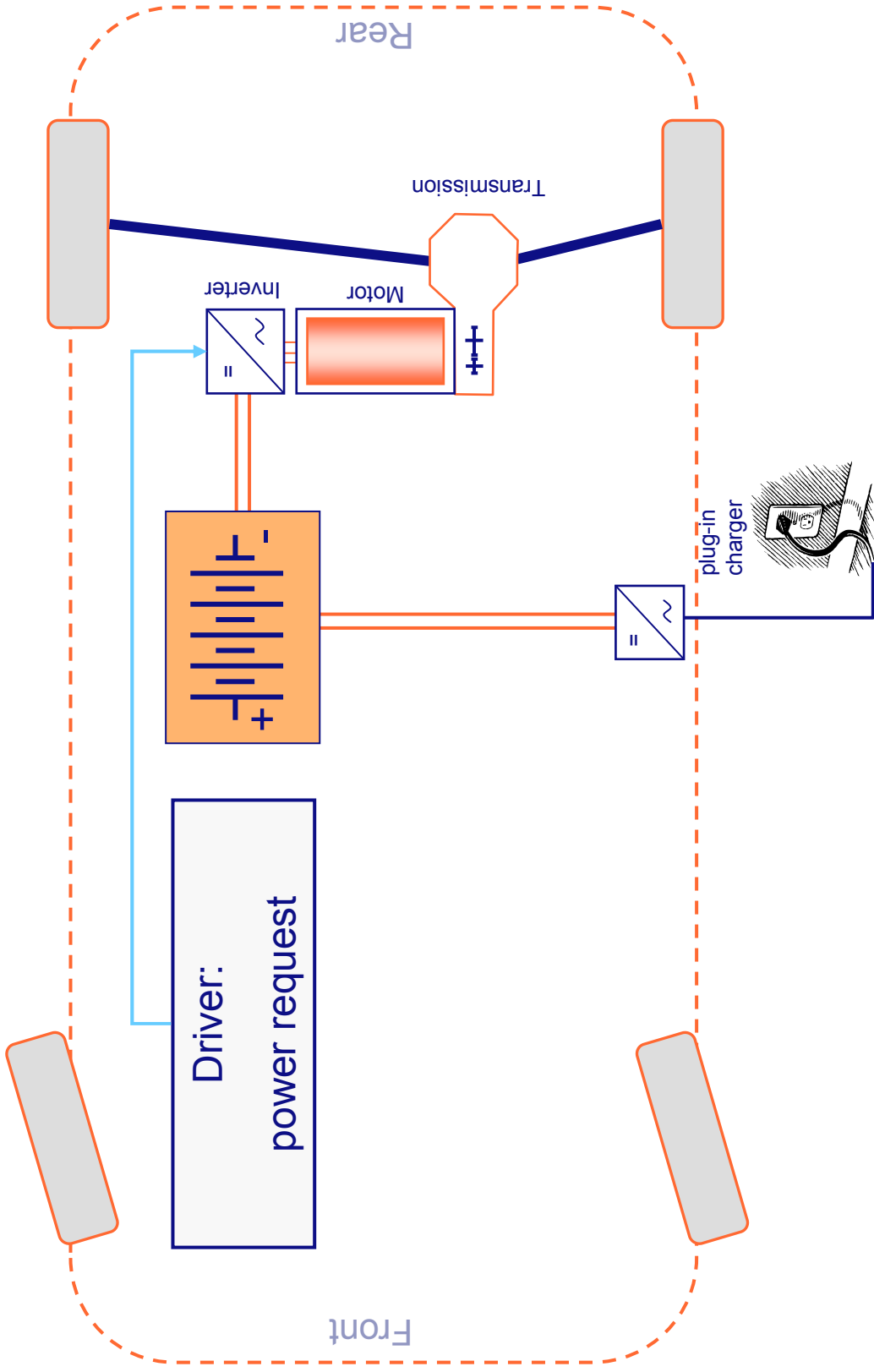
From component control to system integration



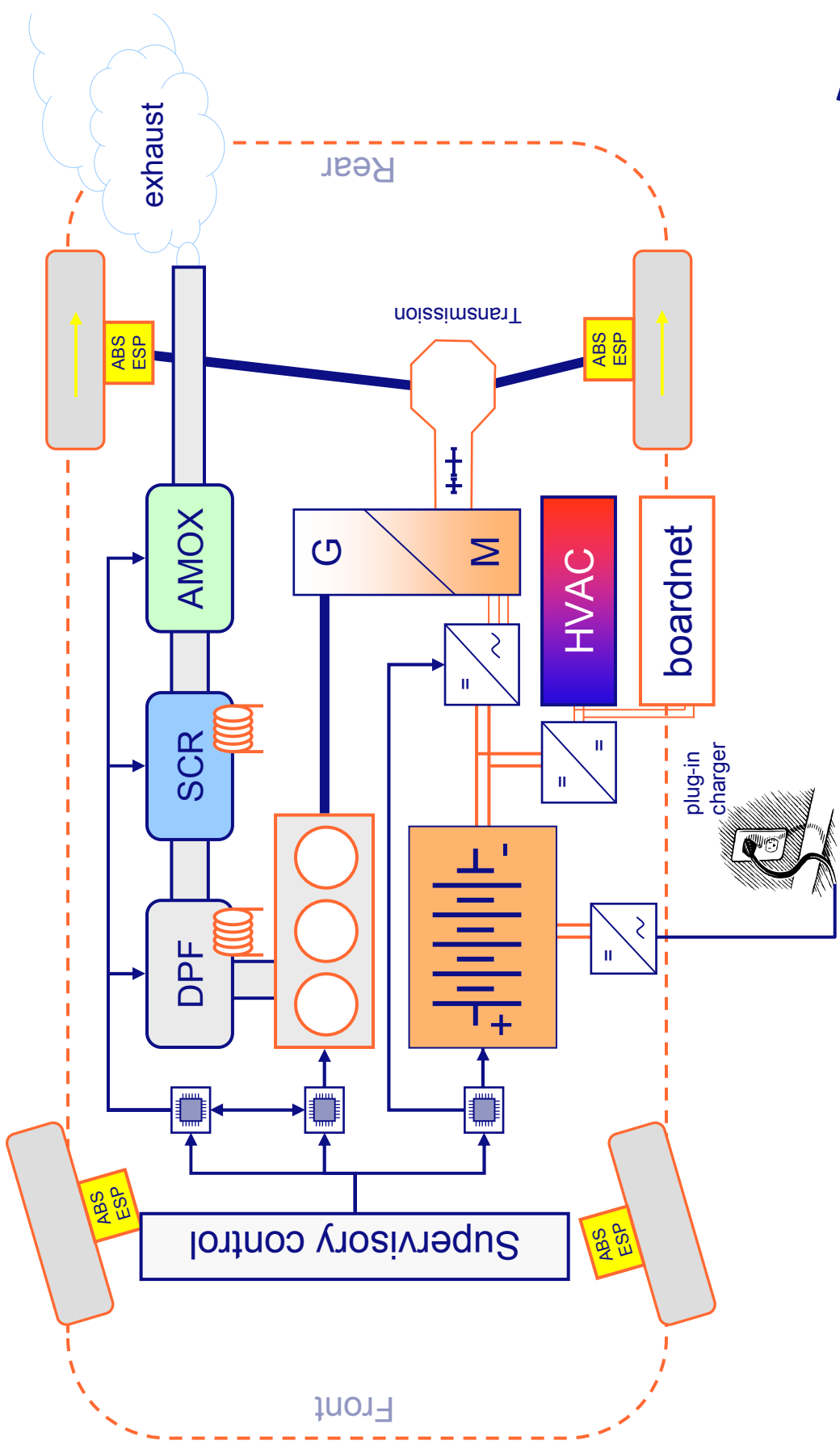
Example: control State of Charge of a battery



Straightforward electric powertrain control



Electric powertrain control with Range Extender



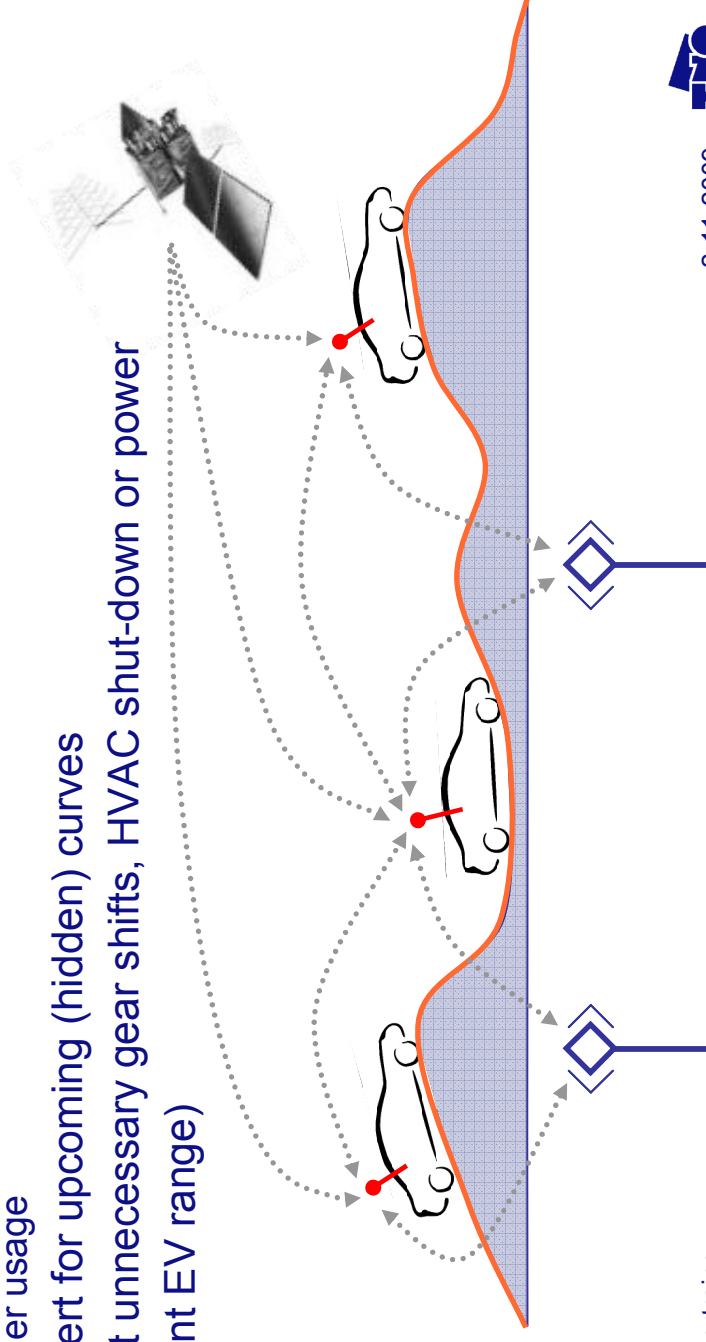
Control objectives for a single vehicle:

- Minimize energy consumption / CO₂ emission
 - Extend the electric range (increase application)
 - Reliability: enable driving up to the next charging station
- Minimize exhaust gas emissions in case RE is switched on to zero
- No compromise regarding safety and comfort (e.g. AirCo, powersteering)
- Increase drivability: added value



eHorizon: navigation based energy management

- Electronic horizon, i.e. look beyond visible horizon using detailed topographic information
- Enabler to improve:
 - Energy consumption (predictive energy management):
 - E-auxiliaries usage: HVAC buffering
 - Engine and gearshift control, e.g. delay upshift at approach of slope
 - SOC planning (budgetting)
 - Range extender usage
 - Safety: speed alert for upcoming (hidden) curves
 - Comfort: prevent unnecessary gear shifts, HVAC shut-down or power derating (to extent EV range)



Required control developments

1. Battery management (also for new battery technologies)
2. Advanced energy management / supervisory control
3. eHorizon, eRange prediction, predictive control
4. Smart grid control (vehicle-2-infrastructure and vice versa), loading strategies, communication protocols

