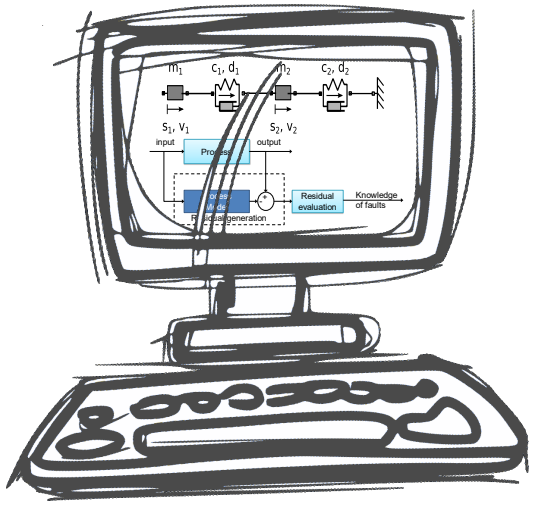
“eFMI” explained in 2’
From Physical Models to ECU Software

Recorded July 15, 2021

Oliver Lenord (Bosch Research)



EMPHYSIS

Aug. 2017 - Feb. 2021

efmi

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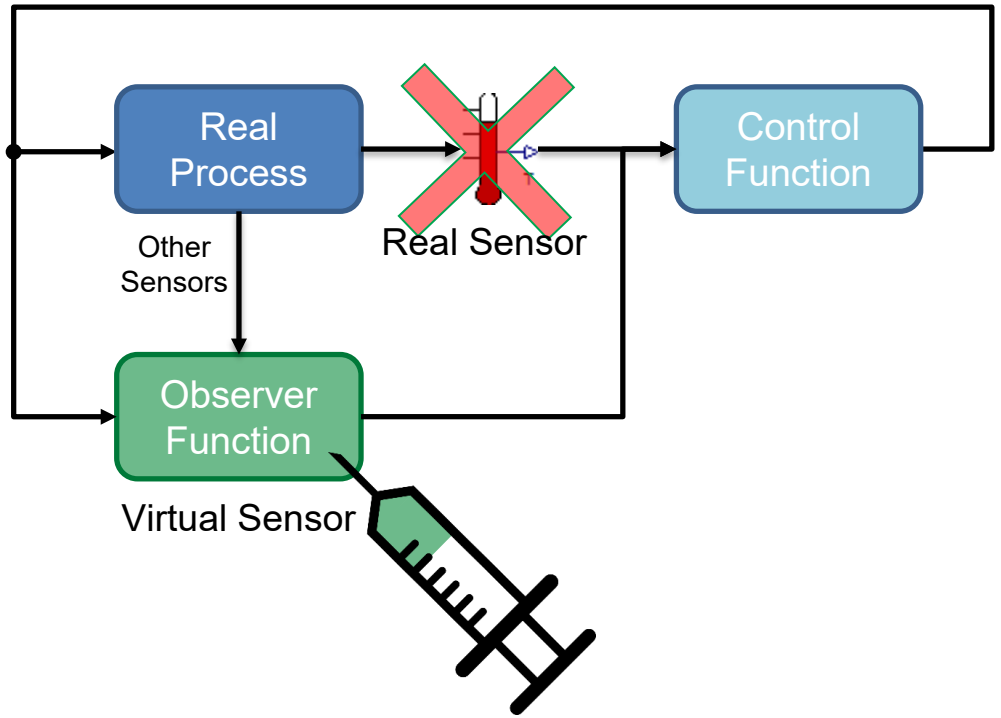
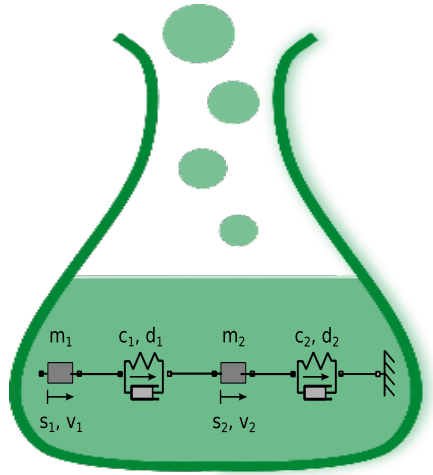
Why?
Physical models for embedded software



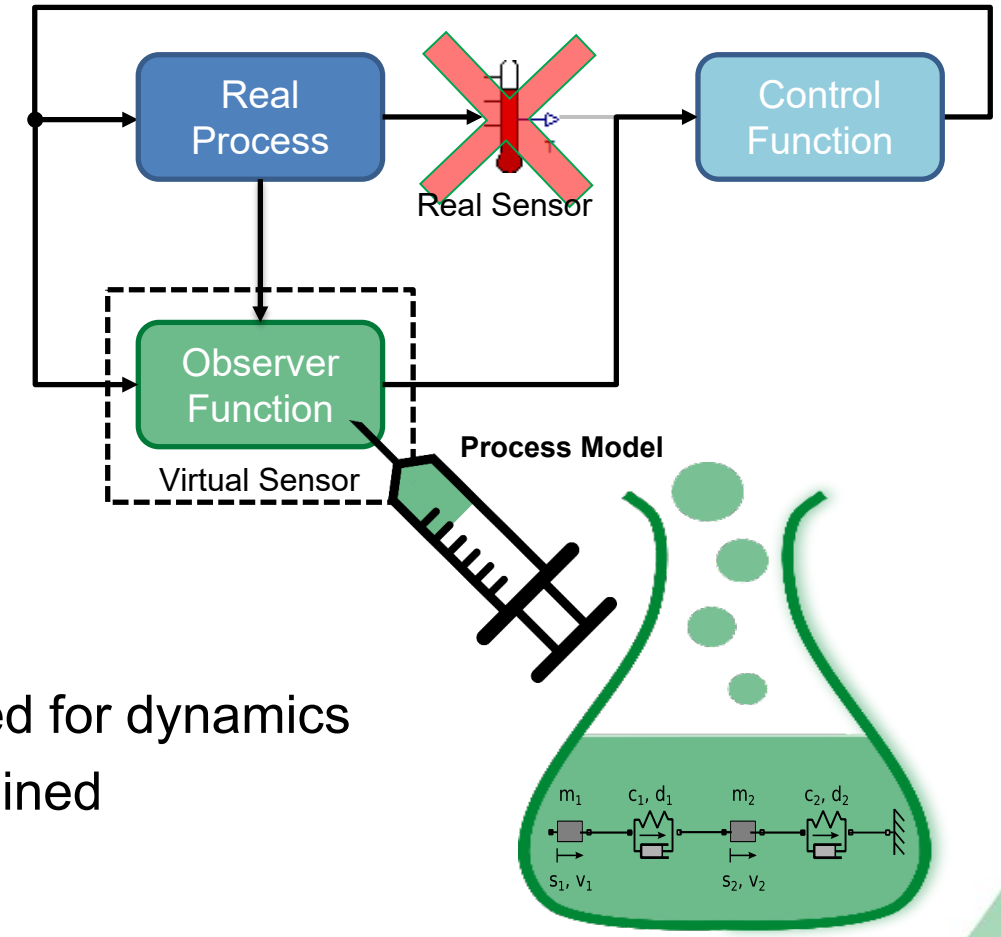


Process Model

Why?
Physical models for embedded software

Online physical models key technology for advanced engine control software:

- virtual sensors, i.e., observers,
- model-based diagnosis,
- inverse physical models as feed forward part of control structures, and
- model predictive control.



Physical Model

Physical models:

- Typically described by differential equations, best suited for dynamics
- Complementary to data-based modeling, can be combined
- Reduced calibration effort due to physical parameters

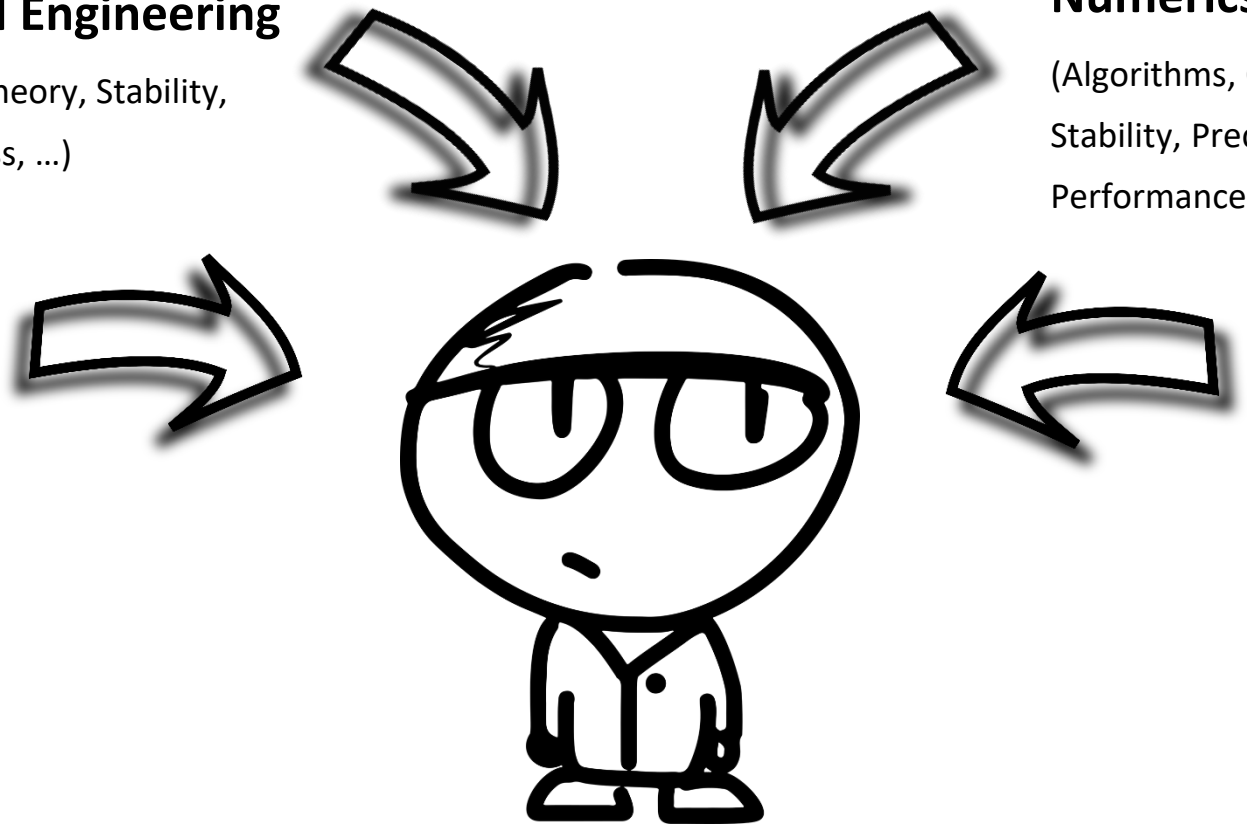
Why?
State-of-the-art

Control Engineering

(System Theory, Stability, Robustness, …)

Numerics

(Algorithms, Complexity, Stability, Precision, Realtime Performance…)



Physical Modeling

(Domain Knowledge, Physical Principles & Phenomena, System Dynamics, Model Validation, …)

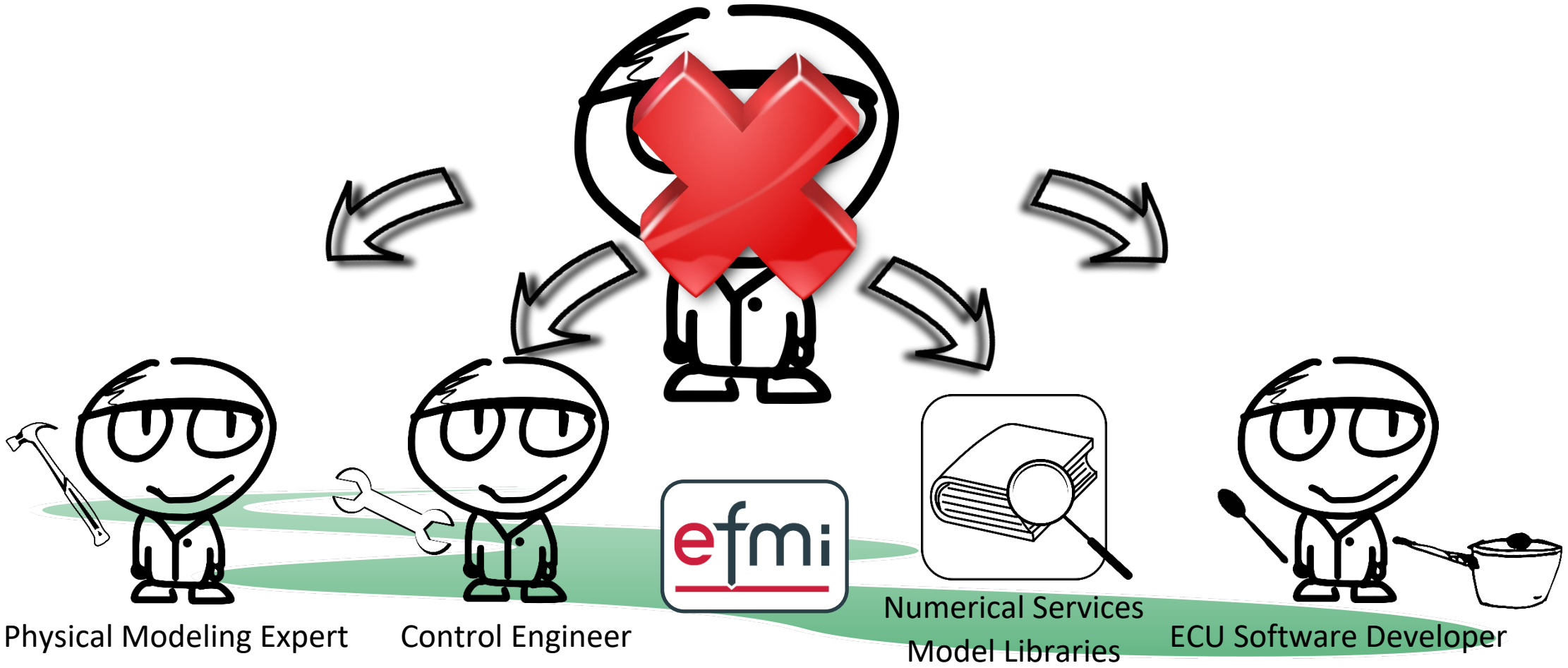
ECU Software

(MISRA, ASIL, MSR, AUTOSAR, …)

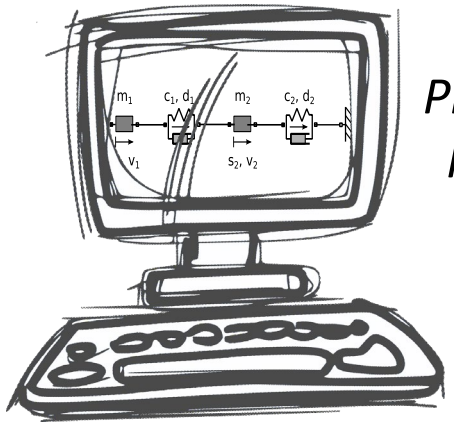
Super Hero Function Developer

Why?

New standard, new tool chains, new ways of collaboration

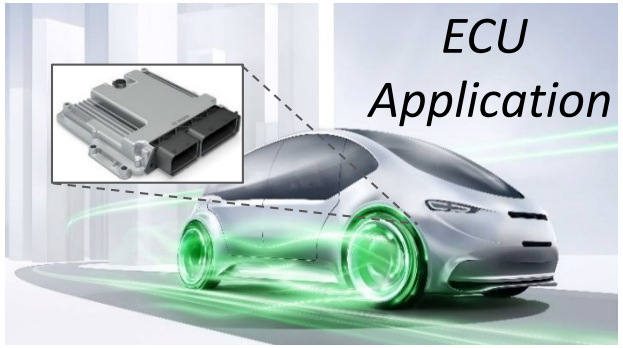


How?
The eFMI workflow



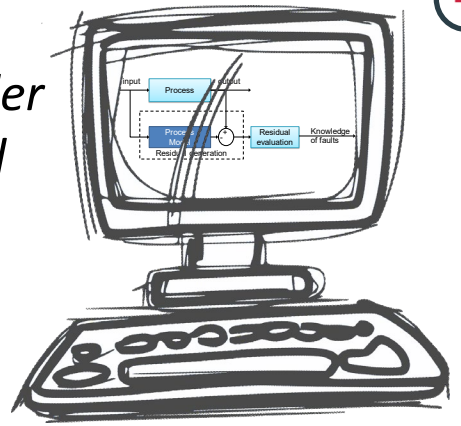
Physical Model

Production Code



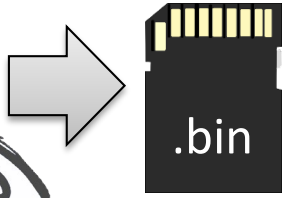
ECU Application

efmi



Controller Model

ECU Software



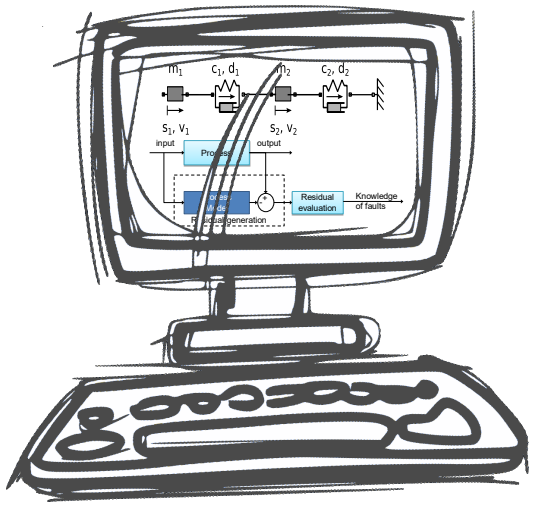
Model-based development with “eFMI”
From Physical Models to ECU Software

ITEA 3

Recorded July 15, 2021

Oliver Lenord (Bosch Research)

➔ Look-up EMPHYSIS results: https://emphysis.github.io/
➔ Visit us on https://efmi-standard.org/
➔ Join the MAP-efmi: https://modelica.org/



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