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Publishable Executive Summary

PANDA project has the objective to provide a disruptive and open-access model organization for system simulation and whole vehicle simulation with the goal to reduce the time to market for electrified vehicles. Simulation is a tool more and more used in vehicle development and this tool is in a continuous transformation as the digital technologies and capabilities are in a fast-growing period. The big advantage of using simulations during development of a product is that it takes less time to evaluate the performance of the product, in our case the vehicle systems and the global vehicle. Therefore, improving simulations will lead to a faster vehicle development, a cost reduction of the development and a cost optimization of the vehicle.

The methodology for model organization proposed in PANDA project is based on the EMR (Energetic Macroscopic Representation) formalism as a graphical guideline. Using this formalism, PANDA partners have developed models for main systems of a plug-in hybrid vehicle (P-HEV) and a global model of the vehicle was built with these models.

One of the features of the proposed methodology is the flexibility of the simulations given by the possibility of direct replacing of a model of a component or a system with another model of the same component or system but with a different complexity. This feature gives the possibility to very easily change the simulation type one can perform on the same global architecture. A quick replacement of a model and some tuning on simulation parameters can provide a simulation for a system validation or a simulation for the validation of a global performance of the vehicle. In this report, besides the validation of global vehicle simulation, the flexibility of the simulation architecture when models are changed is tested.

Simulation results for the global traction system of a P-HEV are compared with physical measurements performed on the real vehicle. The real vehicle is a parallel hybrid retrofit of a phase 2 Peugeot 308. The vehicle has been modified by VEEM and features, among other components, a 48V 4.8kWh battery, and two 48V electric drives. The vehicle was tested on real driving condition by VEEM, and various physical variables from the powertrain were recorded. Simulations are performed using MATLAB-Simulink © software and Simcenter AMESIM © software provided by the partner SISW. Different complexity models for the electrical drive developed by VEEM are presented and implemented in Simcenter AMESIM © software using EMR model organisation and a black box model. Validation of global vehicle simulation was done by ULille. Multi-level simulations of global vehicle were done by SISW and parameters from simulation are compared with parameters from the real vehicle. Thus, the accuracy and general behaviour of the different powertrain components was validated, and the model organization capability was demonstrated.

To conclude, this report demonstrates that EMR permits easy reconfiguration of the P-HEV architecture, even with additional components or generic parameter values. The P-HEV model has been separated into reconfigurable components which, along with the complete model, can be accessed on the Cloud, using the PANDA Explorer, developed within the PANDA project.

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Table 1: Project Partners

#	Type	Partner	Partner Full Name
1	UNIV	ULille	Université de Lille
2	IND	SISW	Siemens Industry Software SRL
3	UNIV	VUB	Vrije Universiteit Brussels
4	IND	VEEM	VALEO Equipement Electriques Moteur SAS
5	UNIV	UTCN	Universitatea Tehnica Cluj Napoca
6	SME	TY	Tajfun HiL (Typhoon HiL)
7			(change of TUV by TUV-BT)
8	UNIV	UBFC	Université Bourgogne Franche-Comté
9	SME	UNR	Uniresearch BV
10	IND	RTR	Renault Technologie Roumanie
11	SME	Bluways	BlueWays International bva
12	IND	TUV-BT	TUV SUD Battery Testing Gmbh

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