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Optimization of scalaBle rEaltime modeLs and functIonal testing for e-drive ConceptS

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Publishable Executive Summary

Deliverable D6.2 focuses on use case cluster 4 'e-motor, control and inverter design & testing' (Figure 0-1). The high energetic efficiency and, therefore, the attractiveness of an electric powertrain lies mainly in the traction unit: e-motor and inverter. A well-designed electric powertrain can be twice as efficient as the powertrain with a conventional combustion engine. Moreover, a second relevant aspect is the flexibility in terms of volume that can be achieved with an e-traction unit. This is made possible above all using of new materials in the electric motor and inverter, as well as by higher frequencies and better integration of the components. These are two good reasons why electric vehicles are already showing strong growth rates, which is in the interest of all parties involved.

However, shortening the development time of electric motors, inverters and controls is an implicit market requirement that can be derived from the above. Therefore, when designing, implementing and testing these components, all necessary aspects must be considered in order to achieve the best possible result in the first design: electrical, mechanical, thermal, magnetic and control engineering. However, all aspects are difficult to evaluate in one single test environment and, therefore, require research into new methods and test approaches that allow efficient optimization and verification in different phases of development within different test environments was needed.

All activities towards the achievement of the above-mentioned objectives are mainly use case driven and as such developments within each use case contributes to the achievement of one or more overall project targets. In order to make sure that the project objectives will be achieved, OBELICS introduces industrial and prospective use cases to apply and prove new advanced testing and simulation methods and tools.

Within the OBELICS project, the Use Case Cluster 4 (UCC4) has been dedicated to "*E-motor, control and inverter design & testing*" in five different Use Cases which all together have mainly contributed to the reduction of the development process of inverters and e-motors. The five considered Use cases (UCs) are UC4.1 '*20kHz inverter behavior testing and investigation*', UC4.2 '*Advanced inverter architecture, design and testing*', UC4.3 '*High-frequency inverter design and testing*', UC4.4 '*E-motor controller layout and validation with high-fidelity models* ' and UC4.5 '*Multivariate high fidelity models for e-motors*'.

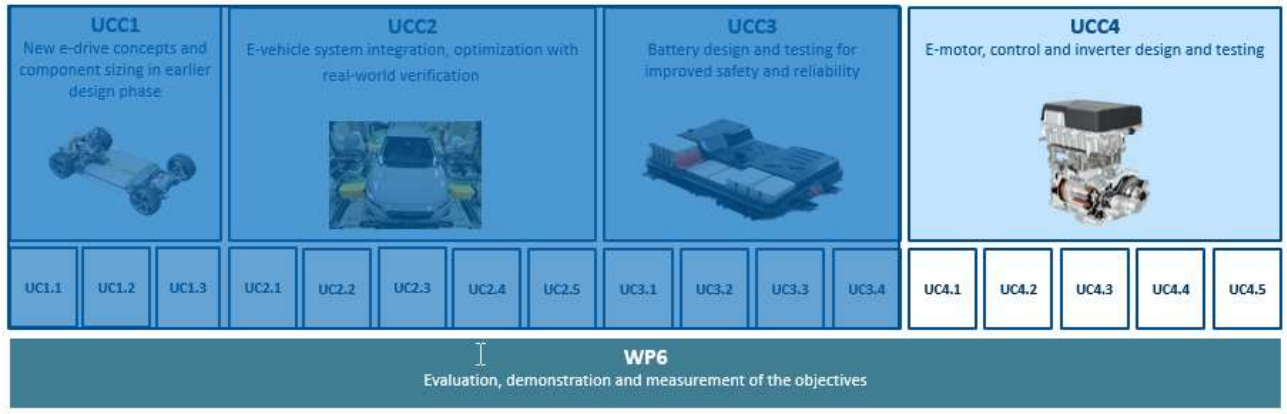

Figure 0-1: UCC OBELICS overview with a specific D6.2 focus on UCC4

UCC4 has an average improvement of 72.8%; which goes beyond the 40% project objective. Moreover, one UC contributes to improve the vehicle efficiency by 20%, as target by the project. Finally, the safety target was not directly evaluated in this use case cluster.

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Project partners:

Partner no.	Partner organization name	Short Name
1	AVL List GmbH	AVL
2	Centro Richerche Fiat SCpA	CRF
3	FORD Otomotiv Sanayi Anonim sirketi	FO
4	Renault Trucks SAS	RT-SAS
5	AVL Software and Functions GmbH	AVL-SFR
6	Robert Bosch GmbH	Bosch
7	SIEMENS INDUSTRY SOFTWARE NV	SIE-NV
8	SIEMENS Industry Software SAS	SIE-SAS
9	Uniresearch BV	UNR
10	Valeo Equipements Electroniques Moteurs	Valeo
11	Commissariat à l'Energie Atomique et aux Energies Alternatives	CEA
12	LBF Fraunhofer	FhG-LBF
13	FH Joanneum Gesellschaft M.B.H.	FHJ
14	National Institute of Chemistry	NIC
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16	University Florence	UNIFI
17	University of Surrey	US
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