PROGRESS TO SUCCESS

UC1.3 DC/DC CONVERTERS

Ingeteam / INGETEAM POWER TECHNOLOGY

Use Case objectives

Development of methods and tools for the design; sizing and optimization of the whole Traction Chain; High-power DC/DC converters of high power density aimed to integration of onboard ESS; Medium-low power DC/DC converters for on-board auxiliary system integration.

Development of tools and models for accurate simulation of the system.

Construction of a first prototype of each of the two targeted DC/DC converters.

KPIs

PEBB1 [Low and medium power and unidirectional Converter (PEBB + Inductive elements) of around 180kW / 20kHz for Auxiliary power supplies.]:

Improvement the Power Density up to 0,5kW/L.

Improvement Efficiency in 10% (from 97%).

PEBB2 [High power and bidirectional Converter (PEBB + Inductive elements) of around 500kW / 8kHz for ESS system]:

Improvement the Power Density up to 0,28kW/L.

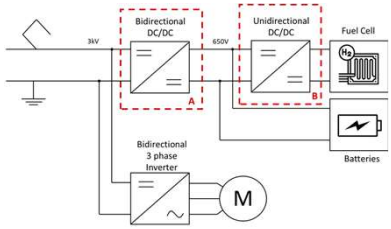
Improvement Efficiency in 10% (from 97%).

Main Obstacles

Existing components/devices (especially inductive elements) have to be evolved for achieving the goals.

Several PEBBs (UC1.2 and UC1.3) share components.

Versatility of the products is mandatory for roof, machine room and underframe location of the converter in the train.



Motivation

50% of the European railway tracks are not electrified. Consequently, their exploitation relies on Diesel-Electric Trains, which does not fit with the climatic goals established in Europe. Power electronics are a core technology for electrification.

The importance that ESS and auxiliary systems is becoming a reality and their integration in traction converters is mandatory.

Level of maturity of DC/DC power converters in railway is below that of other elements of the traction chain.

The development of Battery and FC (Fuel Cell) based onboard energy storage for new designs and retrofit of existing designs is indispensable. Optimized DC/DC converters properly integrated with traction converters are key for this purpose.

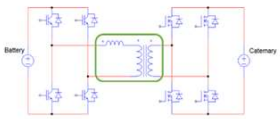
This necessarily involves the use of semiconductors (SiC).

Relevance

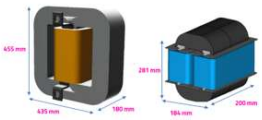
Very high, as the railway market is growing and demanding complete/complex solutions including new on-board energy storage functionalities.

Markets

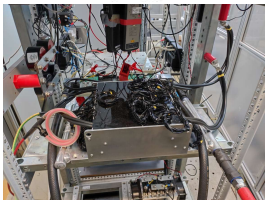
Medium power European market of regional trains.

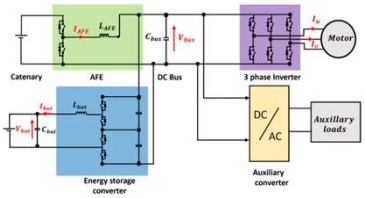


DAB



Transformer + inductor design for DAB topology





Schematic representation of the downscaled testbench

Real downscaled testbench

The project has been accepted for funding within the Key Digital Technologies Joint Undertaking (KDT JU), a public-private partnership in collaboration with the HORIZON Framework Programme and the national Authorities of Germany, Belgium, Spain, Sweden, Netherlands, Austria, Italy, Greece, Latvia, Finland, Hungary, Romania and Switzerland, under grant agreement number 101096387. Co-funded by European Union.