

MECHANICAL ENGINEERING

MUR DM 117/AVL - High Voltage Battery Systems with high modularity for a wide range of use cases

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019] AVL ITALIA S.R.L. [P.iva/CF:02676930015]
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Context of the research activity	<p>The present research program is devoted to the development of a design methodology for High Voltage Battery Systems exploiting the high modularity and applicable to different technologies. The methodology should be valid also for high performance battery systems with supposedly low production rates (e.g. <1000 units/year), hence the main focus is the reduction of R&D costs as opposed to the optimization of variable costs (or piece price).</p> <p>Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23002030004</p>
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Objectives	<p>The large majority of battery systems is specifically developed for each vehicle model/platform. Many Industrial actors are focusing in technologies allowing for an increased modularity of their battery systems in order to reduce R&D costs while improving performance KPIs.</p> <p>The present research program aims at applying the same basic principles to high performance battery systems with supposedly low production rates (e.g. <1000 units/year). Therefore the main focus will be on the reduction of R&D costs as opposed to the optimization of variable costs (or piece price). To achieve such a goal, several KPIs are needed to be taken into consideration:</p> <ul style="list-style-type: none">• the geometrical characteristics of the final battery system,• the required performances,• the selection of the right cell format,• the structural properties allowing for the optimization of mass and mass distribution,• the best cooling technology <p>The access to the latest cell data is also considered as a given, through the utilization of one or more database tool.</p> <p>Usually all the tasks mentioned above are performed manually due to the high complexity, but any automation tool may help in delivering the same results with increased efficiency. Furthermore, several potential applications</p>
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must be taken into consideration, hence allowing for the selection of a few solutions that could be suitable for the utilization in several projects.

The proposed research proposal is in line with research programs of the Spoke 2 "Sustainable Road Vehicles" of the Centro Nazionale per la Mobilità Sostenibile.

The final objectives of this activities are summarized here below:

- Identify the methodologies and KPIs which are helping with the selection of the best solution for high performance BEVs, also in view of potential application in several vehicle models, e.g. cell format, average dimension of the cells, cooling technology, etc.
- Provide a certain level of automation in tasks that are usually performed by human beings, such as the selection of the best cells and the electrical configuration allowing for the best compromise between several targets, such as max voltage, capacity, power density.

Skills and competencies for the development of the activity

The candidate should have the following competence:

- Thermal and mechanical design of mechanical and mechatronic systems for automotive applications,
- Dynamic analysis of integrates systems,
- Vibrations test analysis and experimental test analysis in general,
- Modelling of multiphysics systems using numeral approaches.