A HOLISTIC FRAMEWORK FOR POWER ELECTRONICS

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Abstract

The ubiquitous role of Power Electronics in delivering and controlling electrical energy makes the innovation of these technologies a strong priority in relation to sustainable development goals all over the world. Power electronics technologies were deemed mature already in the early 2000s and have always relied on innovations in materials for their own progress, while the design processes have remained substantially unchanged. Approaches based on Linear Design Workflow, roadmapping, and traditional forms of modelling and simulations seems to be unfit to fulfill the current need for innovation of Power Electronics. It is here introduced an overview on a holistic framework for power electronics design that tackles innovation needs with systems engineering, decision making, multidisciplinary optimization, and knowledge-based technologies. The framework is based on subject-independent, process-independent abstractions from systems engineering and decision making, and exploits multidisciplinary optimization for automatic exploration of the design space. The framework is said to be “holistic” because it can address the problems related to power electronics design considering the whole system from source to load and allows integration in the design process of information from the context (market, societal systems) thus reducing the gap between designers and customers and, more in general, reducing the uncertainty associated to the design decisions. The framework employees also knowledge-based technologies to support the accurate construction of power electronics systems descriptions, the automatic management of the models used for analyses, the capturing and reuse of knowledge generated during the design process, and the automatic validation against dominion knowledge. This approach has already found applications in other industries (aerospace, automotive) achieving remarkable time reductions in complex designs and with the added advantage of automating the less creative design activities.