

Grid-Connected Advanced Power Electronic Systems (GRAPES)

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Power Module Layout Synthesis (PowerSynth)

This power module layout synthesis tool takes a circuit description and produces a physical layout ready for manufacturing in minutes compared to the days and weeks required today by electronic packaging engineers. This breakthrough saves thousands of dollars in design costs and produces designs that operate more reliably and efficiently. This, in turn, leads to more efficient power electronic converters and motor drives. More efficient converters and motor drives translate into greater range for electric vehicles, better fuel efficiency of aircraft, more efficient environmental control systems for buildings, and improved energy efficiency in the electric power grid.

This breakthrough focuses on design automation. GRAPES researchers automated what is normally done by hand. The physical design of power modules normally takes three to four months by an expert by hand. This tool enables physical circuit layouts in only $\frac{1}{2}$ an hour. The tool can also be used by non-experts to as a means to get them engaged in the design process.



Electric vehicles will produce extended range with improved power electronics. Credit: Tesla

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Stated simply, the end result of this design automation tool is improved electrical efficiency of power converters and motor drives. The work impacts many applications in the electric power grid, transportation, and building energy sectors. It also result in reliability improvements in all types of power electronics.

Economic impact: The main impacts are in the products that were mentioned above as being made more efficient and reliable. More efficiency electrical devices will certainly have many positive environmental impacts. The result of the tool itself is realized through a commercial software product. Currently, GRAPES is working with ANSYS to finalize the research.

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