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A novel digital magnet power supply approach

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Programmable logic and integrated technologies, as SoC, FPGA and DSP, have became mature enough to be employed in high performance magnet power supply applications. The use of a configurable mixed current and voltage digital control, combined with adaptable complex algorithms for protections (e.g. quench in superconducting magnets) and auxiliary integration (e.g. transverse flux density in a dipole gap) allows obtaining the perfect fit for each specific magnet application. An entire series of power supplies, coming from a background of particle accelerator applications, has been developed for both bipolar and monopolar operation with high bandwidth (fast fields as in corrector magnets and steerers) and high adaptability with a user-friendly interface and an embedded Linux OS that allows users to implement their own applications directly on the power supply. The use of 24-bit Analog-to-Digital converters and state-of-the-art PWM generation (with possible application of dithering techniques to reach 60-65 ps resolution) enables to obtain fields actuations in the ppm-level range. Some power converters, for specific applications (usually dipoles or superconducting), are equipped with closed-loop zero flux transducers that feeds their signals to temperature-stabilized electronics to reach current temperature coefficient values of 1 ppm/K.

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