**Data-driven Controller Design for High Precision Pulsed Power Converters for Bumper Magnets of the PS Booster**

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A new data-driven approach using the frequency response function of a system is proposed for designing robust digital controllers for the injection bumper magnet (BSW) power supplies of the PS Booster. The powering of the BSW requires high precision 3.4 kA to 6.7 kA trapezoidal current pulses with 2 ms flat-top and 5 ms ramp-up and ramp-down time. The tracking error must remain within +/- 50 parts-per-million (ppm) during the flat-top of the trapezoidal reference, and +/- 500 ppm during the ramp-down. The BSW is powered with a SIRIUS P2P power converter and the current through the magnet is controlled in closed-loop form with a 2-degree-of-freedom controller at a sampling rate of 10 kHz. A two-step convex optimization algorithm is performed for obtaining the controller parameters. The effectiveness of the method is illustrated by designing the controller for a full-scale prototype of the BSW system at CERN, which is in the framework of the LHC Injector Upgrade (LIU) project.