



Contribution ID: 25

Type: not specified

New generation of digital integrators at CERN

Rotating coils is the method preferred in the measurement of field and field quality for accelerator magnets. One of the fundamental points of this instrument is represented by the digital integrators. These perform the integration of the pickup coils voltage in the angular domain, i.e according the triggers provided by an angular encoder. The resolution of the integration process can become a critical issue when the coils speed increases or in varying magnetic field measurements with high ramp rate.

In this talk we describe the design principles of a new generation of numerical integrators based on the use of a DSP (Digital Signal Processing). The central idea is to perform a real time numerical integration on the samples of the coils voltage, acquired at high sampling frequency and good resolution (A/D conversion). With a selection of the best electronic components available nowadays we expect a resolution on the integrated voltage with a maximum increase of 5 orders of magnitude as compared to digital integrators previously developed at CERN. An experimental proof demonstrator of a new numerical integrator based on 18 bit Analog to Digital converter was realized using a PXI data acquisition system. Results of an accurate metrological characterization of this prototype as well as a comparison with the old PDI integrator performances are discussed.

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Track Classification: Devices