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Numerical modelling of the CERN PS booster cavity feedback loops

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The Radio-Frequency (RF) system of the CERN Proton Synchrotron Booster (PSB) features Finemet-loaded cavities covering a wide range of frequencies. However, this system presents a significant longitudinal broad-band impedance, which must be reduced to maintain beam stability, particularly at highest intensities. To counteract the induced voltage, a direct wide-band RF feedback is employed, covering the entire frequency range. It is complemented by Multi-Harmonic feedback (MHFB) that implements narrow-band filtering at integer multiples of the revolution frequency. Recent measurements have revealed that the MHFB has a substantial effect on longitudinal beam stability. To validate its impedance in the closed-loop regime, a detailed model of the system's behaviour is necessary. This contribution outlines the development of the numerical equivalent for the PSB cavity feedback loops, which is based on dedicated measurements used to characterize the systems'performance. Comparisons between simulations and measurements are carried-out to validate the model.

Footnotes

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