

ACCELERATOR SEMINAR

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GSI

Thursday, 8. July 2021 at 4 pm

Online-Seminar via Zoom

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Closed orbit feedback systems for the fast the SIS18 synchrotron of GSI

A fast and robust closed orbit feedback (COFB) system for the on-ramp orbit correction at SIS18 synchrotron of FAIR project is realized. SIS18 has some peculiar behaviors including on-ramp optics variation, very short lengths of the ramps (200ms to 1s) and a cycle-to-cycle variation of beam parameters. The realized fast COFB system being robust against above mentioned features of SIS18 is a first of its kind and the course to its realization led to some novel contributions in the field of closed orbit correction. A new method relying on the discrete Fourier transform (DFT)-based decomposition of the orbit response matrix (ORM) has been introduced, exploiting the symmetry in the arrangement of beam position monitors (BPMs) and the corrector magnets in the synchrotrons. A nearest-circulant approximation has also been introduced for synchrotrons having slight deviation from the symmetry, making the method applicable to a vast majority of synchrotrons. Moreover, the performance and the stability analysis of COFB systems in the presence of ORM mismatch between the synchrotron and the feedback controller is presented. The COFB systems are divided into slow and fast regimes and a new stability criterion consistent with measurements, is introduced. The practicality of the criterion is verified experimentally at COSY Jülich and is used for the analysis of various sources of ORM mismatch at SIS18. The on-ramp orbit correction in SIS18 is demonstrated for the horizontal plane of SIS18, for the disturbance rejection up to 600 Hz.



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