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Coupled-bunch longitudinal instabilities with a harmonic cavity

Wednesday, 10 May 2023 16:30 (2 hours)

We present a theory of coupled-bunch longitudinal instabilities for storage rings that employ a harmonic cavity to lengthen the bunch. We find growth rates associated with the m=0 and m=1 modes for both "optimally" and "overstretched" bunches; the former is a Robinson-like instability, while the latter corresponds to the "periodic transient beam loading" effect described in Ref *. By self-consistently including longitudinal feedback, we then show that controlling the instability may require feedback damping rates that are higher than the growth rate. For parameters considered, we find that controlling the the m=0 mode may require damping rates that are up to 2 times higher than the instability growth rate, while in many cases the m=1 mode cannot be stabilized with any feedback gain. We verify these predictions using particle tracking for APS-U like parameters.

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Footnotes

- He, Li, Bai, and Wang. PRAB 25, 024401 (2022).

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Yes

Primary author: LINDBERG, Ryan (Argonne National Laboratory)

Presenter: LINDBERG, Ryan (Argonne National Laboratory)

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