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Longitudinal beam dynamics study for the triple radio-frequency system in electron storage rings

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For diffraction-limited storage rings, the triple radio-frequency (RF) system has been proposed to achieve further bunch lengthening or to meet specific requirements for longitudinal injection. The choice of RF cavity parameters for the triple RF system has a significant influence on the longitudinal beam dynamics. Macro-particle tracking simulation is commonly used to accurately analyse this influence. This allows for the correct design of the RF cavity parameters. In this paper, we extend the STABLE code [1] by adding a harmonic cavity module so that it can be used to study the dynamics for the triple RF system. Assuming a triple RF system for the Hefei Advanced Light Facility storage ring, we have conducted in-depth investigations on the corresponding dynamics. It is found that there are two types of beam instabilities that possibly occur to significantly degrade the bunch lengthening.

Footnotes

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