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Temporal profile shaping for a dispersive section using a multi-objective genetic algorithm

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The importance of shaping temporal profiles in accelerator physics is highlighted by a wide range of applications, such as plasma acceleration and improved performance in free electron laser applications. In our study, we focus on controlling the dispersion in a bunch compressor and the energy chirp of the beam entering the compressor to achieve diverse temporal profiles. The transmission of electron beams through dispersive regions, like bunch compressors and transport lines, can significantly impact the beam's temporal profile. Failure to rigorously control each component's parameters may result in deviation from the desired beam profile. We propose the application of a multi-objective genetic algorithm to address this one-to-many problem. After multiple optimization iterations, we obtained several feasible solutions for controlling the dispersion section and various energy chirps to achieve desired temporal profile.

Footnotes

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