Contribution ID: **192** Type: **not specified**

A first taste of Non- Linear Beam Dynamics II

Thursday 3 October 2024 12:10 (1 hour)

Nonlinear dynamics can impact the performance of a particle accelerator in a number of different ways, depending on the type of the accelerator and the parameter regime in which it operates. Effects can range from minor changes in beam properties or behaviour, to serious limitations on beam stability and machine performance. In these notes, we provide a brief introduction to nonlinear dynamics in accelerators. After a review of some relevant results from linear dynamics, we outline some of the main ideas of nonlinear dynamics, framing the discussion in the context of two examples of different types of accelerator: a single-pass system (a bunch compressor) and a periodic system (a storage ring). We show how an understanding of the origins and nature of the nonlinear behaviour, together with the use of appropriate analysis tools, can prove useful in predicting the effects of nonlinear dynamics in different systems, and allow the design of appropriate corrections or mitigations.

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