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Dynamic aperture prediction based on machine learning

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The dynamic aperture(DA) is one of the most important parameters of nonlinear beam dynamics in storage rings. It describes the transverse phase space region where the motion of a particle can remain stable. In the design and optimization of storage rings, long-term particle tracking is usually required to ensure an sufficient DA. However this process is very time consuming. This study explores the possibility of using machine learning methods for DA prediction. Firstly, several regression models from magnet strengths to resonance driving terms are constructed using different machine learning methods, showing that the use of machine learning can be applied to the nonlinear performance analysis of storage ring lattice. Then predictive regression models from magnet strength to DA are constructed, and the results show that artificial neural network have better prediction accuracy. The method will be further developed for nonlinear analysis and optimization of storage ring.

Footnotes

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