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## APS Outstanding Dissertation Award Winner: advanced methods for storage ring nonlinear beam dynamics design and implementation

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Nonlinear lattice optimization and correction become increasingly important as storage ring light sources continue to push towards ultra-low emittances. An advanced algorithm based on machine learning technique, called multi-generation Gaussian process optimizer (MG-GPO), was applied to find optimal nonlinear lattice solutions, and was demonstrated to outperform traditional algorithms. It was also implemented in online optimization and resulted in improved machine performance. The need to drive and maintain large beam oscillation amplitude for nonlinear beam dynamics measurement and correction motivated the study of resonant driving with swept frequency. We discovered that there exists a drive amplitude threshold for successful beam excitation. The dependence of the threshold on frequency sweep rate and lattice parameters is theoretically analyzed. The results were verified by both simulations and experimental data.

### Footnotes

### Funding Agency

### Paper preparation format

### Region represented

North America

**Primary author:** SONG, Minghao (Brookhaven National Laboratory)

**Presenter:** SONG, Minghao (Brookhaven National Laboratory)

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