Simulation methods of 3D coupled storage ring based on SLIM formalism

ZHAO Jingyuan, TANG Chuanxiang, DENG Xiujie, PAN Zhilong, LI Zizheng, CHEN Liwei, Tsinghua University, Beijing, China
Alexander Chao, Tsinghua University, Beijing, China, also at Stanford University, Stanford, USA

SLIM Formalism

SLIM is a linear storage ring beam dynamic formalism based on transport matrix and eigen-analysis. It can self-consistently analyze linear coupled/uncoupled storage ring and give the following results without using any courant-snyder auxiliary functions.

- All the linear dynamics
- Closed orbit disortion
- Equilibrium beam size and shape

SLIM Formalism

$M(s_2|s_1)_{6\times6}$ → eigenvectors → linear dynamics

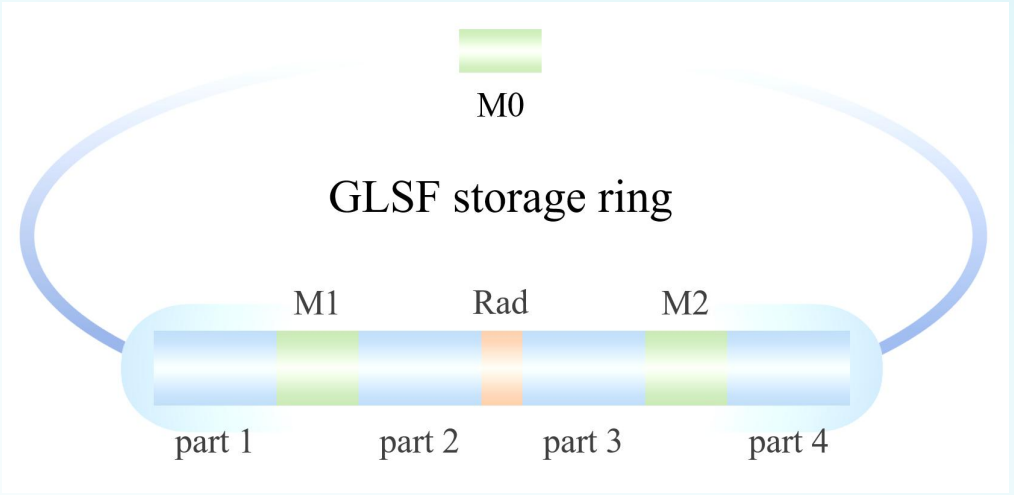
Courant-Snyder Formalism

$M(s_2|s_1)_{2\times2}$ → auxiliary functions → linear dynamics

We have extended SLIM and processed all elements with thick lens analysis, which speeds up SLIM code calculation. SLIM can thus be used as a linear self-consistent physical computing core for MOGA and machine learning.

Generalized longitudinal strong focusing

Generalized longitudinal strong focusing (GLSF) scheme aims to produce coherent EUV radiation turn by turn in laser-driven storage rings. It invokes transverse-longitudinal coupling and then attains a short bunch length with significantly reduced modulation laser power.



We present a method for analyzing local lattice design with SLIM, and combine SLIM and MOGA to carry out lattice design of GLSF. Finally, we achieve a bunch length of less than 5nm at the storage ring radiator.