Contribution ID: **91** Contribution code: **THP02** Type: **Poster Presentation**

Advanced figure control scheme for piezoelectric deformable mirror

Thursday 18 September 2025 16:40 (1 hour)

Mirrors in beamlines exhibit various imperfections such as polishing defects, gravity-induced sag, clamping strain, misalignment, vacuum force distortions and heat-load-induced thermal deformations. These imperfections introduce aberrations including beam broadening, diffraction, defocusing and wavefront distortions, thus challenging the beamline's performance. To address these issues, considerable efforts have focused on active and adaptive optics. Piezoelectric deformable mirrors offer an effective approach for surface shape control, wavefront aberration correction, and focus adjustment. To fully exploit their potential, finite element simulation of thermal–piezoelectric–mechanical behavior and precise shape control algorithms under voltage constraints are essential. This study presents an advanced figure control scheme to enable direct simulation and resolve the inverse problem of shape control. The corrected surfaces achieve sub-nanometer RMS errors and fulfill diffraction-limited requirements with strong adaptability. The method could apply to various active and adaptive optics, with potential for generalization in free-electron laser and synchrotron radiation beamlines.

Footnotes

Funding Agency

Author: SUN, Baoning (Dalian Institute of Chemical Physics)

Co-authors: Dr LI, Qinming (Institute of Advanced Science Facilities, Shenzhen); Dr YANG, Chuan (Institute of Advanced Science Facilities, Shenzhen); Dr HU, Kai (Institute of Advanced Science Facilities, Shenzhen); Dr XU, Zhongmin (Institute of Advanced Science Facilities, Shenzhen); Dr DONG, Xiaohao (Shanghai Advanced Research Institute); Dr ZHANG, Weiqing (Dalian Institute of Chemical Physics); Dr YANG, Xueming (Dalian Institute of Chemical Physics)

Presenter: SUN, Baoning (Dalian Institute of Chemical Physics)

Session Classification: Thursday Poster Session

Track Classification: SIMULATION: FEA methods