Fast Orbit Feedback Control in Mode Space
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Controller Structure

1. Convert error to mode space
2. Apply different dynamics, $q_m(z^{-1})$ to each mode
3. Convert correction to input space

Zero Setpoint

Error signal, $\ddot{d}$

Measured beam position $y$

Disturbance $d$

Process

Singular Value Decomposition (SVD) of the response matrix $R = \Phi \Sigma \Psi^T$

Figure: Internal Model Control structure in modal form
Controller Design and Performance

- Relationship between the disturbance and the measured beam (Sensitivity) used to select dynamics
- Sensitivity is shaped to match the disturbance content at each mode

![Power Spectrum Density (dB) showing sensitivity contour](image1.png)

![Vertical Integrated Electron Beam Motion at BPM1](image2.png)