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Robust Controller Design for an Electron Beam Projection Lithography System

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Abstract

This paper discusses the vibration control of an electron beam projection lithography (EBL) system. Two main disturbances, namely load disturbances from the machine and ground disturbances from the environment, should be considered for EPL system. Since the suspension settings to suppress these two disturbances are conflicting, we construct a double-layer optical table and apply disturbance response decomposing (DRD) techniques to insulate the disturbances independently. That is, a passive control structure is used to isolate the vibration from ground disturbances, while an active control structure is applied to reduce the vibration from load disturbances.

Because the full optical table has seven degree of freedom, symmetric transformation is applied to decouple it into the bounce/pitch and roll/warp half-table models. These two half-table models can be further decoupled into the bounce, pitch, roll and warp quarter-table models, based on the assumptions of *kl*-simplicity, for H_∞ robust controller design. From both simulation and experimental results, the designed controllers are shown to effectively reduce vibrations of the EPL system.