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Mon-Mo-Po1.07-05 [80]: Superconducting stage actuation

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In semiconductor photolithography equipment, high productivity and nanometer precision of the motion stages are combined to enable shrink in chip dimensions at reasonable cost. High-force density linear and planar motors drive the stages which carry the reticle mask and the wafer with acceleration levels of multiple tens to hundreds of m/s^2 . Superconducting actuation might be a next step to increase productivity of semiconductor equipment.

Motion stages offer a new challenge to superconducting motors and their design. The dynamic motion profiles induce significant AC losses, requiring dedicated thermal design of the coils. The combination with precision pose challenges to the dynamics of the superconducting structural mechanics, as well as to the precision with which the superconducting coils are manufactured and assembled. Finally, the usage of superconducting magnets for actuation of a production machine poses specific challenges to reliability and recovery times.

The contribution will offer a glimpse on the expected loads on the superconducting coils and the specific challenges for a semiconductor motion stage application.

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