

ISOLATION LIMITS IN MAGNETIC SUSPENSIONS

Eric H. Maslen and George T. Gillies

**University of Virginia, Department of Mechanical and Aerospace Engineering
Charlottesville, Virginia 22904**

Magnetic suspensions can completely eliminate mechanical contact between a suspended, isolated platform and the environment surrounding it. Current applications which emphasize precise positioning and/or vibration isolation include lithographic platens, microgravity isolation for space borne experiments, very high resolution inspection systems, and pointing mechanisms for satellites. Related applications which take advantage of magnetics to eliminate contaminants or permit vacuum operation include bearings for flywheels, eximer laser fans, and turbomolecular pumps. An interesting application highlighting the potential to provide very low loss suspension is spinning rotor vacuum gauges.

Especially in vacuum environments, magnetic suspension seems to promise limitless isolation, perhaps only bounded by the clearance between the rotor and the magnetic stator suspending it.

However, numerous factors endemic to the suspension mechanism limit the isolation that can actually be achieved. In this work, we examine the potential isolation of platforms with and without umbilicals and establish the predominant effects due to magnetics, power amplification, sensing, and umbilical mechanics that limit this isolation. Excitation is presumed to arise primarily due to base motion but we also consider stray fields and, for non-evacuated systems, air currents. Given bounds for excitation mechanisms and for uncertainty in measurements and calibration of the suspension components, we provide a structured analysis to estimate bounds in isolation performance. We also provide a brief survey of the state of the art to obtain some notion of currently practical values for these bounds and the resulting practical isolation performance.