ROBUST TRIPLE-MODE COMPENSATOR FOR HARD DISK DRIVES WITH DYNAMIC FRICTION

Abstract of the Disclosure

Friction existing between any two surfaces having relative motion is nonlinear, multiform, and is difficult to model. Nonlinear friction in the actuator pivot of a hard disk drive (HDD) limits the low frequency gain, which prevents the system positioning accuracy from further improvement. This problem is much more pronounced for the severe nonlinearity at the micrometer level. The conventional two-mode proximate time optimal servomechanism (PTOS) is inadequate for immediate future hard disk drives because of the existence of restrictions in the particular design approach. A triple-mode control scheme, and its variations, as presented herein, include (a) a proximate time-optimal controller (PTOC) having a relatively large output is used for track seeking, (b) a robust compensator having a relatively small output is used for track following to compensate for friction and other nonlinearities, and (c) a bridging (connection) control to guarantee the continuity of the control signals. Because of the introduction of an extra mode, additional freedoms for controller design are made available for improved performance. The robust compensator is non-model based in the sense that it does not depend on the models of friction and other nonlinearities. This makes the invention simpler and more practical than conventional systems.

(Figure 11 is to be published)