Optimal Dynamic Performance for a High-Precision Stage System*

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Abstract

Scientists at the Advanced Photon Source (APS) are continually stretching the limits of x-ray measurement techniques. To this end, mechanical structural dynamic stability is of primary importance. System dynamic performance of multidimensional stage groups, such as those found in optical instrument positioning systems, is dependent upon both individual component behavior and the system configuration. Experimental modal-analysis techniques have been implemented to determine the six-degree-of-freedom stiffnesses and damping for individual stages and groups. The key to the approach is a combination of experimental measurements and numerical simulation. Experimental dynamic-performance data, such as displacement, dynamic stiffness, and damping, are used in computer models to home in on problem areas faster than either a computational approach or experimental approach alone would allow.

In this paper, two recent examples of this methodology are presented: the diagnosing of a multiaxis goniometer installed in the 2-ID-D experimental station, and the investigation of actuator/stage group optimization for multiaxis positioning systems.

Keywords: high-precision, dynamic stability, actuator, stage, goniometer

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