

Instron

Motion Platform Designed with Embed SE



Argo II. Courtesy of LightSpeed Simulation Systems, Inc.

[Embed SE's] comprehensive selection of nonlinear functions combined with its graphical interface allowed [Instron engineers] to easily design the motion platform from a classical control perspective. During simulation, as [Instron engineers] interactively tweaked the system values, the effects of the changes were immediately reflected in the graphs.

When Instron Corp., of Canton, Massachusetts, teamed up with LightSpeed Simulation Systems, Inc. to build a new, modern entertainment, motion simulator — named the Argo II — they used Embed SE (formerly called VisSim) to develop and test the motion platform.

The platform, an advanced servo-hydraulic motion system with 3 degrees of freedom and over 2 Gs of vertical acceleration, provides the heaves, rolls, and pitches for the Argo II.

The Challenge

“One of the most time-consuming aspects of the design was modeling the nonlinear behavior of the platform,” said Albert Barrett, Principal Engineer at Instron. “With the many linkages among the hydraulics, position transducers, and pistons of the motion platform, the response of the capsule would not follow linearly from the behavior of the transducers and pistons.”

The Solution

Embed SE's comprehensive selection of nonlinear functions combined with its graphical interface allowed Barrett to easily design the motion platform from a classical control perspective.



INDUSTRY

Motion Control

CHALLENGE

Design a servo-hydraulic motion system with 3DOF and 2+ Gs of vertical acceleration

SOLUTION

Use Embed SE to simulate the nonlinear behavior of the platform

BENEFITS

- Comprehensive block library speeds up the development process
- Thorough testing through simulation uncovered flaws earlier in the design process
- Delivered final product on time

To obtain data of the nonlinear behavior, Barrett connected the motion controller to a PC with an I/O board. When the controller received a signal, it calculated the PID error control loop and sent a valve drive signal back to the software. Barrett used this empirical data to complete the model in Embed SE.

During simulation, dynamic graphs displayed motor current, position, and velocity behavior. As Barrett interactively “tweaked” system values, the effects of the changes were immediately reflected in the graphs. “One of our key discoveries was that the bandwidth of the proportional valves was too low. When we replaced the valves with ones having a wider bandwidth, we saw the improvement in the system,” explained Barrett. After thorough testing through simulation, Barrett arrived at the optimal settings for the motion controller.

The Results

Final testing with Lightspeed’s capsule and simulation software was completed in time to unveil the Argo II at the International Association of Amusement Parks and Attractions (IAAPA) tradeshow in New Orleans, where it received overwhelmingly positive reviews from the attendees. “Part of the appeal of the Argo II is that it is a fine-tuned, well-tested system,” said Barrett. “Not a hurried product that just made the deadline. ”

The VisSim™ product line has been renamed to Embed™ and Embed SE™



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