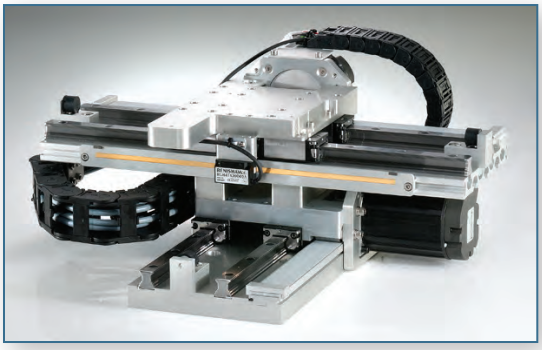
Bell Everman
Solutions For A World Of Motion



Semiconductor Packaging

Replace a ballscrew-driven stacked XY stage that places tested and diced semiconductors in output trays.

TECHNICAL REQUIREMENTS:

The stage required a linear drive system versatile enough to make two very different types of moves. One is a long travel move at 400 mm/sec. The other is a short, high-speed move of 13 mm that must settle to 10 microns in 150 milliseconds.

The customer's incumbent ballscrew technology could not make either of the desired moves, making the goal throughput impossible. Linear motors and higher-performance ballscrew drives, while capable of meeting the motion requirements, would have exceeded the customer's cost targets by [40-50%].

The short index moves and accuracies were not achievable by the incumbent ball-screw stage without the addition of a linear encoder, and a higher pitch screw would be required to achieve the higher speed without screw whip.

The moving mass seen by the lowest axis in the system was 38Kg with a bi-directional accuracy goal of ± 5 microns based on the positioning reference from a 1-micron Renishaw optical linear encoder. Ultimately, the only way to achieve the fast index moves was to close the servo loops using the linear encoder, which requires a true backlash-free drive line from motor to payload.

Low-cost drives, whether ballscrew or rack-and-pinion, have too much backlash to deliver the stable, high-gain control loop required by this application.

THE SERVOBELT SOLUTION

After an extensive engineering evaluation [that included linear motors], the customer successfully applied our ServoBelt in a new XY stage design exceeds all dynamic and cost requirements.

ServoBelt, controlled in a single-loop mode that takes feedback just from the linear encoder, won the job over more expensive linear motor solutions by providing:

- **A zero backlash solution.** ServoBelt has no backlash, which proved essential when tuning a control system that would meet the customer's dynamic requirements.
- **Inherent damping** ServoBelt inherently offers excellent mechanical damping, which allows for very high tuning gains, typically 4 times the velocity and positional gains, which translates into extremely low settling times. Linear motors, by contrast, must simulate this damping servo-amplifier electronics, which inherently reduces the possible positional gain.

A linear motor could have succeeded at this job. But achieving the power density needed to produce the required 300N of continuous force would have resulted in an unacceptably long motor coil and high costs. ServoBelt offered both a cost and size advantage.

CONCLUSION

In high-performance applications such as semiconductor, position ServoBelt as a "linear motor killer." ServoBelt offers zero backlash, excellent mechanical damping and a high power density at a lower cost and smaller form factor than an equivalent linear motor.