ADVANCED MEMS TESTING MACHINES INTRODUCED BY ETEC INC.

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By Rosemary Clandos
Small Times West Coast Correspondent

PEABODY, Mass. -- Watching MEMS devices move in three dimensions has always been a problem for designers and researchers, but that and other puzzles have been solved by Etec Inc. with the unveiling of two new machines, the first of their kind in the world.

Etec, a Peabody, Mass.-based MEMS test company, debuted their MEMS motion analyzer (MMA) and M/STeP-o at the Optical Fiber Communication Conference and Exhibit in Anaheim, Calif., in mid-March. Etec's machines are the first fully automated test and measurement tools for MEMS.

The MMA is a turnkey system for characterizing, or analyzing the performance and endurance, of the complex motions of MEMS and MOEMS in the design and development stage. The M/STeP-o also characterizes the motions of MEMS and MOEMS, and it is used to test devices that are already in the wafer and die stage, where it is targeted for volume production.

"There is no other technology that does what (the MMA) can do," said Stuart Brown, director of the Boston office of Exponent, the nation's largest engineering consulting firm. "It really is the only game in town.

There are very few ways one can characterize how MEMS move other than using the MMA. I believe it is an essential piece of equipment."

"It enables engineers to see and measure dynamic motions you could never see before," said Arthur J. Holzknecht, vice president of sales and marketing at Etec. "That translates into efficiency and productivity."

In addition to having data-analysis and report-generation capabilities, the MMA has real-time and slow-motion video tools. Those features allow researchers to move quickly from design and engineering to production, Holzknecht said.

"At the microscopic level, MEMS structures do not necessarily behave in the way you expect. The machines enable you to see these things and this allows for the better production of MEMS devices," said Holzknecht.

Although the M/STeP-o has many of the same features that the MMA has, the M/STeP-o is designed for factories that have weathered the Darwinian development struggle and are ready to put their design-tested devices into production. A company could buy just the M/STeP-o and use it for design, development and production line testing. However, researchers would need to stop production line testing when they needed to do engineering-intensive testing.

To solve possible problems with products, companies will be able to use both machines to work out kinks in MEMS technology. For example, if a MEMS device fails in the field, it can be brought back into a failure analysis lab and tested on a MMA.

"You find out what went wrong, then refine the device to correct that failure," said Holzknecht. "You develop tests on your MMA to identify that failure mode and screen for

it. The tests are translated to the M/STeP-o because you used the same technology. So it is all seamless. Now you bring the new devices into production and you screen for that failure mode. That's how we close the whole loop."

Brown said that by using the MMA, MEMS manufacturers can bring products to market faster and with greater reliability. Studies have shown that testing and packing represent 40 percent to 80 percent of device costs, said Holzknecht. He expects Etec's machines will cut the testing costs by up to 50 percent.

The machines took roughly 20 engineering years to develop. The MMA sells for $150,000 to $250,000 fully loaded. The M/STeP-o, which may replace roughly 10 manual operators, sells for $665,000 to $1 million, fully configured.

"We put the most emphasis on the equipment side of the business," Holzknecht said. "That's where we see all the growth."

Etec had its start as an electronic test engineering company in 1986 and now has offices in Rochester, N.Y., Seoul and Paris. The company's 30-plus employees see their machines being used in fiber optics, optical telecom, pressure MEMS and inertial MEMS -- such as MEMS gyroscopes and accelerometers.

For years, Etec has been a leading tester for MEMS accelerometers, which are used to deploy air bags in cars. Inertial MEMS can also be used in commercial applications such as video games and virtual reality.

Some of the technology that went into building the MMA came out of Massachusetts Institute of Technology and passed through UMech, a Boston-based firm with which Etec has a strong contractual and working relationship.

Other technologies such as optical profilometry and laser dobbler vibrometry solve some of the puzzles that Etec's tools seem to have mastered; but it would take several machines to do what one of Etec's can do, Holzknecht said.

Optical profilometry measures profiles of MEMS including surface roughness and mirror curvature. Laser dobbler vibrometry measures velocity changes in dynamic motion by measuring the frequency shift of light.

Etec's roster of customers includes top companies in the telecom field, but Etec has signed non-disclosure agreements with all of them.

"People who are working with us don't want others to know they're using our products. It validates the premise that the machines work," said Holzknecht.

The company has installed more than 30 test systems since 1994. This year, Etec's goal is to market 25 or more M/STeP-o machines and about 35 MMA's.