

Keysight Technologies

Characterizing Electromagnetic MEMS Optical Scanners Using the E4980A Precision LCR Meter

Application Note



- High-speed list sweep function
- DC parameter measurement function (Option 001)
- High-speed measurement, scanner interface (Option 301)

Introduction

This application brief describes how the Keysight Technologies, Inc. E4980A can greatly improve the test efficiency of electromagnetic MEMS optical scanners.

E4980A Precision LCR Meter

The Keysight E4980A Precision LCR Meter, with exceptional accuracy and speed, is the ideal tool for research and development, as well as manufacturing test.

Electromagnetic MEMS Optical Scanners

For MEMS optical scanners, the electromagnetic actuator is often used as the actuator to move the mirrors of optical scanners. By putting magnets around the movable part on which the coil has been fabricated and applying current to the coil, the Lorentz force moves the object (Figure 2). In many cases, the movable part is resonated by applied AC current.

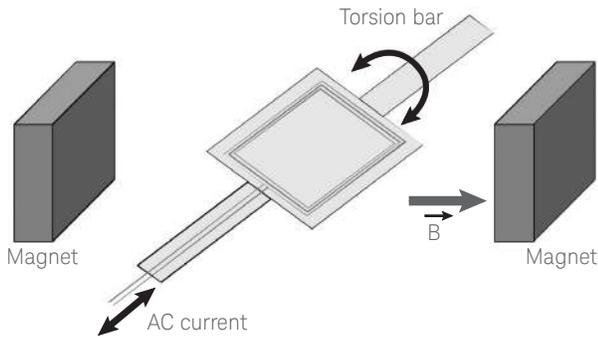


Figure 2. Principle operation of an electromagnetic optical scanner

High-Speed Measurement of Resonant Frequency and Q-factor

For an electromagnetic optical scanner, the most important characteristics are resonant frequency and Q-factor (Figure 3). The impedance value is also important to know for power consumption. Because an electromagnetic MEMS optical scanner is a very small micro-fabricated device, precise measurements are required to determine its characteristics.

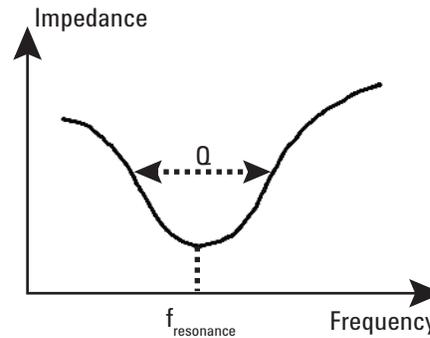


Figure 3. Resonant frequency and Q-factor

Impedance measurement, therefore, requires a test instrument with high measurement accuracy and repeatability. The Keysight E4980A Precision LCR Meter, with 0.05% basic impedance accuracy and superior repeatability, as well as up to 201 points of high-speed list sweep function, is the ideal tool for evaluation of impedance of electromagnetic MEMS optical scanners (Figure 4).

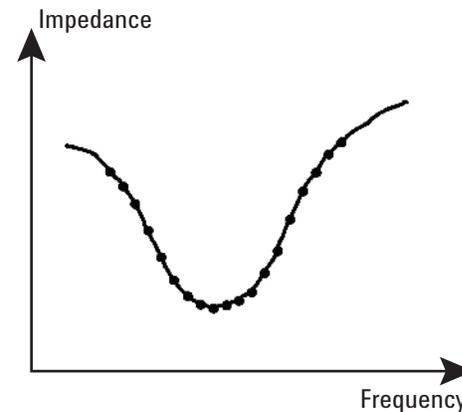


Figure 4. Concept of the impedance measurement by high-speed frequency list sweep

Simultaneous Measurements of DC Resistance and Inductance

DC resistance value is one of the most important parameters for a coil. In addition, the failure mode of the coil is generally open and DC resistance measurement is helpful to detect that failure. A DC resistance meter, which is often used, can measure only DC resistance so to evaluate inductance, another measurement instrument is required.

The E4980A (with Option 001) provides this DC parameter measurement function, which enables evaluation of inductance and DC resistance simultaneously (Ls-Rdc), so there is no need for a separate DC resistance meter. The Keysight E4980A greatly contributes to reducing the cost of production equipment as well as improving throughput.



Figure 5. Test ports of the E4980A

High-Speed Measurements Increase Manufacturing Test Throughput

Throughput is always a major issue in the manufacturing test process. The Keysight E4980A Precision LCR Meter achieves a measurement speed that is five times as fast as that of the legacy Keysight 4284A, which improves productivity both for design and manufacturing. In addition, the 128-channel scanner interface (Option 301) for multiple device test, and smaller footprint than the 4284A, is suitable for manufacturing test (Figures 6 and 7).

Summary

The Keysight E4980A Precision LCR Meter, which provides highly accurate and repeatable measurements, as well as having a high-speed list sweep function, is the ideal measurement instrument for testing electromagnetic MEMS optical scanners. Using the DC parameter measurement function (Option 001) and 128-channel scanner interface (Option 301) together can improve test productivity in both design and manufacturing.

For more information, please refer to the following literature and websites:

- Keysight E4980A Brochure (P/N 5989-4235EN)
- Keysight E4980A Data Sheet (P/N 5989-4435EN)
- Keysight Technologies Impedance Measurement Handbook (P/N 5950-3000)
- MEMS/NEMS Device Measurement Solution:
www.keysight.com/find/mems
- Keysight E4980A Precision LCR Meter:
www.keysight.com/find/e4980a



Figure 6. Scanner interface of multiple device testing



Figure 7. Small footprint fits easily into the production line

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