Can optical MEMS provide low-cost solutions for field-portable spectroscopy, sensing, and imaging?

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Improving current state-of-the-art infrared (IR) detector and focal plane array (FPA) technologies is focused on reducing cooling requirements, developing larger-format 2D FPAs, extending to longer wavelengths, and/or adding so-called hyper-spectral/multi-colour capability, which allows real-time spectral information to be gathered from multiple wavelength bands. Hyper-spectral sensing allows standoff detection of chem/bio species in complex media, whereas multi-spectral imaging provides improved target recognition and reduced false alarm rates in imaging scenarios. Both of these technologies have broad applications in remote sensing and spectroscopic/imaging applications in many industrial and civilian arenas, as well as in the military and aerospace sector.

In order to provide a more robust and lower-cost solution in systems with reduced size, weight and power, a microelectromechanical systems (MEMS) based electrically tunable Fabry-Perot filter technology is proposed, that is compatible with individual detectors for chem/bio sensing applications, as well as being suitable for large format 2D IR FPAs for imaging applications. In principle, such a hybridized technology is capable of low-voltage wavelength tuning across the VIS to LWIR wavelength bands for UAV and field-portable applications. This presentation will present: (i) an overview of recently-developed MEMS technologies for applications in the SWIR and MWIR wavelength bands, (ii) current approaches and future work to extend the technology into the VIS/NIR and LWIR wavelength bands, and (iii) possible approaches to extending the technology to large-area tuneable filters for 2D imaging FPAs.