Miniature Visible/Near Infrared Imaging Spectrometer
Technology #16351

Applications

- Commercial remote sensing, such as crop health and surveying for minerals
- Remote sensing in Unmanned Aerial Vehicles (UAVs)
- Process control applications on production lines such as quality monitoring

Problem Addressed

Imaging spectrometers have excellent viability in both process control applications and commercial remote sensing. However, due to the large size, they are not easily integrated on small vehicles such as UAVs. Existing reflective imaging spectrometers must be flown in aircraft instrument bays or in large wing pods. Some designs also use convex gratings which are in limited supply and often produce straylight. Finally, the all-reflective designs often need to be diamond turned, post polished and shimmed into tight alignment tolerances with respect to each other.

Technology

The invention is a miniature visible/near infrared imaging spectrometer which is small enough to be used in a UAV. This imaging spectrometer provides a spatial map of the spectra from different pixels of the ground image, dispersing the visible and near infrared spectra and covering the wavelength range 400 nm to 2500nm. The design includes a flat low-cost grating, which has minimal straylight, and a cemented doublet is used as the main optical element. The total device volume is a factor of 10 smaller than imaging spectrometer designs with comparable capabilities. The spatial keystone and spectral smile is controlled to less than 0.1 pixels, eliminating the need for data resampling. The simplicity of the fabrication and alignment scheme ultimately leads to a low-cost design suitable for commercial production.

Advantages

- Small size with excellent optical performance
- Simple design easy to fabricate and align
- No data resampling
- No convex gratings

Categories For This Invention:

- Lincoln Laboratory
- Photonics
- Sensors (Photonics)
- Imagers
- Spectroscopy (Sensors)
Intellectual Property:
Visible-infrared plane grating imaging spectrometer
Issued US Patent
9,689,744

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Publications:
Design of a Hyperspectral Imaging Spectrometer for Visible and Near Infrared Region Applications
2014 22nd Signal Processing and Communications Applications Conference
2014
Spectral Imaging for Remote Sensing
Lincoln Laboratory Journal
Vol. 14, No. 1, 2003

External Links:
Lincoln Laboratory
http://www.ll.mit.edu/

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