mometers are subject to unwanted drift. Both electronic reactor sensors are plagued by electrical noise induced by ionizing radiation near the reactor core.

A fiber optic sensor system was developed that is capable of tracking thermal neutron fluence and gamma flux in order to monitor nuclear reactor fission rates. The system provides near-real-time feedback from small-profile probes that are not sensitive to electromagnetic noise.

The key novel feature is the practical design of fiber optic radiation sensors. The use of an actinoid element to monitor neutron flux in fiber optic EFPI (extrinsic Fabry-Perot interferometric) sensors is a new use of material. The materials and structure used in the sensor construction can be adjusted to result in a sensor that is sensitive to just thermal, gamma, or neutron stimulus, or any combination of the three. The tested design showed low sensitivity to thermal and gamma stimuli and high sensitivity to neutrons, with a fast response time.

This work was done by Clark D. Boyd of Luna Innovations, Inc. for Glenn Research Center.

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18701-1.

Compliant Tactile Sensors

Lyndon B. Johnson Space Center, Houston, Texas

Tactile sensors are currently being designed to sense interactions with human hands or pen-like interfaces. They are generally embedded in screens, keyboards, mousepads, and pushbuttons. However, they are not well fitted to sense interactions with all kinds of objects.

A novel sensor was originally designed to investigate robotics manipulation where not only the contact with an object needs to be detected, but also where the object needs to be held and manipulated. This tactile sensor has been designed with features that allow it to sense a large variety of objects in human environments.

The sensor is capable of detecting forces coming from any direction. As a result, this sensor delivers a force vector with three components. In contrast to most of the tactile sensors that are flat, this one sticks out from the surface so that it is likely to come in contact with objects. The sensor conforms to the object with which it interacts. This augments the contact's surface, consequently reducing the stress applied to the object. This feature makes the sensor ideal for grabbing objects and other applications that require compliance with objects. The operational range of the sensor allows it to operate well with objects found in peoples' daily life. The fabrication of this sensor is simple and inexpensive because of its compact mechanical configuration and reduced electronics. These features are convenient for mass production of individual sensors as well as dense arrays.

The biologically inspired tactile sensor is sensitive to both normal and lateral forces, providing better feedback to the host robot about the object to be grabbed. It has a high sensitivity, enabling its use in manipulation fingers, which typically have low mechanical impedance in order to be very compliant. The construction of the sensor is simple, using inexpensive technologies like silicon rubber molding and standard stock electronics.

This work was done by Eduardo R. Torres-Jara of the Massachusetts Institute of Technology for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Refer to MSC-24271-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Cytometer on a Chip

Analyses could be performed rapidly in compact instruments using disposable chips.

Lyndon B. Johnson Space Center, Houston, Texas

A cytometer now under development exploits spatial sorting of sampled cells on a microarray chip followed by use of grating-coupled surface-plasmon-resonance imaging (GCSPRI) to detect the sorted cells. This cytometer on a chip is a prototype of contemplated future miniature cytometers that would be suitable for rapidly identifying pathogens and other cells of interest in both field and laboratory applications and that would be attractive as alternatives to conventional flow cytometers.

The basic principle of operation of a conventional flow cytometer requires fluorescent labeling of sampled cells, stringent optical alignment of a laser beam with a narrow orifice, and flow of the cells through the orifice, which is subject to clogging. In contrast, the principle of operation of the present cytometer on a chip does not require fluorescent labeling of cells, stringent optical alignment, or flow through a narrow orifice. The basic principle of operation of the cytometer on a chip also reduces the complexity, mass, and power of the associated laser and detection systems, relative to those needed in conventional flow cytometry.

Instead of making cells flow in single file through a narrow flow orifice for sequential interrogation as in conventional flow cytometry, a liquid containing suspended sampled cells is made to flow over the front surface of a microarray chip on which there are many cap-