that contains numerous logic cells that can be used to implement traditional integrated circuits. The FPGA contains two PowerPC processors running the VxWorks real-time operating system and are used to execute software programs specific to each application.

The CTP was designed and developed specifically to provide telemetry functions; namely, the command processing, telemetry processing, and GPS metric tracking of a flight vehicle. However, it can be used as a general-purpose processor board to perform numerous functions implemented in either hardware or software using the FPGA's processors and/or logic cells.

Functionally, the CTP was designed for range safety applications where it would ultimately become part of a vehicle's flight termination system. Consequently, the major functions of the CTP are to perform the forward link command processing, GPS metric tracking, return link telemetry data processing, error detection and correction, data encryption/decryption, and initiate flight termination action commands. Also, the CTP had to be designed to survive and operate in a launch environment.

Additionally, the CTP was designed to interface with the WFF (Wallops Flight Facility) custom-designed transceiver board which is used in the Low Cost TDRSS Transceiver (LCT2) also developed by WFF. The LCT2's transceiver board demodulates commands received from the ground via the forward link and sends them to the CTP, where they are processed. The CTP inputs and processes data from the inertial measurement unit (IMU) and the GPS receiver board, generates status data, and then sends the data to the transceiver board where it is modulated and sent to the ground via the return link.

Overall, the CTP has combined processing with the ability to interface to a GPS receiver, an IMU, and a pulse code modulation (PCM) communication link, while providing the capability to support common interfaces including Ethernet and serial interfaces boarding a relatively small-sized, lightweight package.

This work was done by J. Emilio Valencia, Christopher Forney, Robert Morrison, and Richard Birr of Kennedy Space Center. For further information, contact the Kennedy Innovative Partnerships Program Office at (321) 861-7158. KSC-13324

Squeezing Alters Frequency Tuning of WGM Optical Resonator

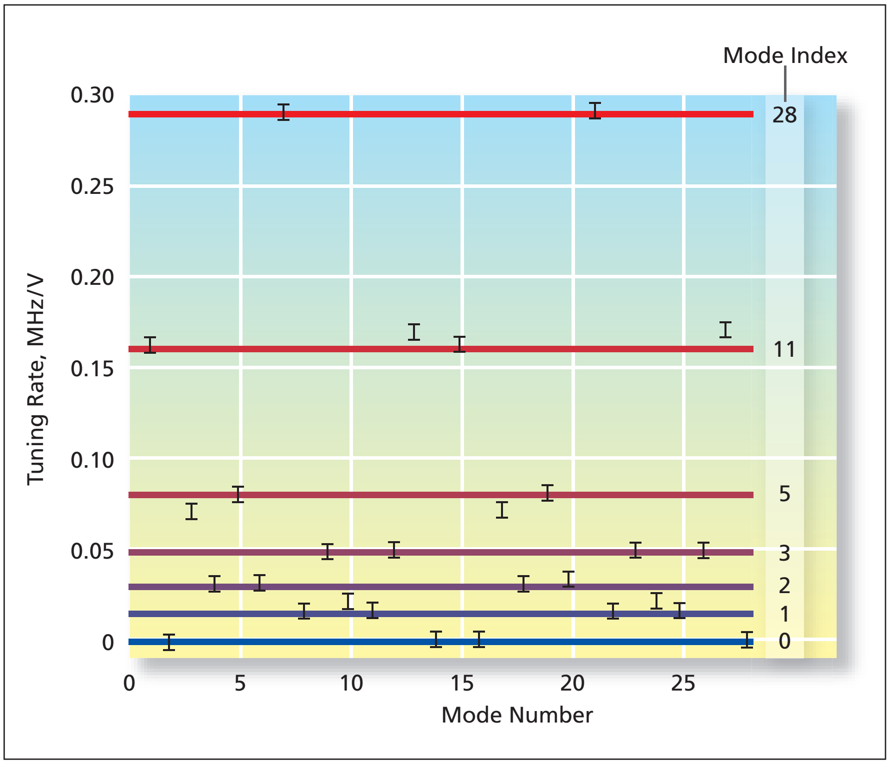
Tuning rates for modes of different indices can be made to differ.

NASA's Jet Propulsion Laboratory, Pasadena, California

Mechanical squeezing has been found to alter the frequency tuning of a whispering-gallery-mode (WGM) optical resonator that has an elliptical shape and is made of lithium niobate. It may be possible to exploit this effect to design reconfigurable optical filters for optical communications and for scientific experiments involving quantum electrodynamics.

Some background information is prerequisite to a meaningful description of the squeezing-induced alteration of frequency tuning: The spectrum of a WGM resonator is represented by a comblike plot of intensity versus frequency. Each peak of the comblike plot corresponds to an electromagnetic mode represented by an integer mode number, and the modes are grouped into sets represented by integer mode indices. Because lithium niobate is an electro-optically active material, the WGM resonator can be tuned (that is, the resonance frequencies can be shifted) by applying a suitable bias potential. The frequency shift of each mode is quantified by a tuning rate defined as the ratio between the frequency shift and the applied potential. In the absence of squeezing, all modes exhibit the same tuning rate. This concludes the background information.

It has been demonstrated experimentally that when the resonator is squeezed along part of either of its two principal axes, tuning rates differ among the groups of modes represented by different indices (see figure). The differences in tuning rates could be utilized to configure the resonance spectrum to obtain a desired effect; for example, through a combination of squeezing and electrical biasing, two resonances represented by different mode indices could be set at a



Tuning Rates were calculated from resonance-frequency-vs.-voltage measurements on an elliptical WGM resonator squeezed along its semimajor axis.

specified frequency difference — something that could not be done through electrical biasing alone.

This work was done by Makan Mohageg and Lute Maleki of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1)..

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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