

tance Gaussian is applied (to bring out the stronger corners), and then each value in the entire window is summed and stored. The required components of the equation are in place, and it is just a matter of taking the determinant and trace. It should be noted that the trace is being weighted by a constant κ , a value that is found empirically to be

within 0.04 to 0.15 (and in this implementation is 0.05). The constant κ determines the number of corners available to be compared against a threshold σ to mark a "valid corner."

After a fixed delay from when the first pixel is clocked in (to fill the pipeline), a score is achieved after each successive clock. This score corresponds with an

(x,y) location within the image. If the score is higher than the predetermined threshold σ , then a flag is set high and the location is recorded.

This work was done by Arin C. Morfopoulos and Brandon C. Metz of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-47202

Special Component Designs for Differential-Amplifier MMICs

Transistors and transmission lines are optimized for differential operation.

NASA's Jet Propulsion Laboratory, Pasadena, California

Special designs of two types of electronic components — transistors and transmission lines — have been conceived to optimize the performances of these components as parts of waveguide-embedded differential-amplifier monolithic microwave integrated circuits (MMICs) of the type described in the immediately preceding article. These designs address the following two issues, the combination of which is unique to these particular MMICs:

- Each MMIC includes a differential double-strip transmission line that typically has an impedance between 60 and 100 Ω . However, for purposes of matching of impedances, transmission lines having lower impedances are also needed.
- The transistors in each MMIC are, more specifically, one or more pair(s) of InP-based high-electron-mobility transistors (HEMTs). Heretofore, it has been common practice to fabricate each such pair as a single device configured in the side-to-side electrode sequence source/gate/drain/gate/source. This configuration enables low-inductance source grounding from the sides of

the device. However, this configuration is not suitable for differential operation, in which it is necessary to drive the gates differentially and to feed the output from the drain electrodes differentially.

The special transmission-line design provides for three conductors, instead of two, in places where lower impedance is needed. The third conductor is a metal strip placed underneath the differential double-strip transmission line. The third conductor increases the capacitance per unit length of the transmission line by such an amount as to reduce the impedance to between 5 and 15 Ω .

In the special HEMT-pair design, the side-to-side electrode sequence is changed to drain/gate/source/gate/drain. In addition, the size of the source is reduced significantly, relative to corresponding sizes in prior designs. This reduction is justified by the fact that, by virtue of the differential configuration, the device has an internal virtual ground, and therefore there is no need for a low-resistance contact between the source and the radio-frequency circuitry.

The source contact is needed only for DC biasing.

These designs were implemented in a single-stage-amplifier MMIC. In a test at a frequency of 305 GHz, the amplifier embedded in a waveguide exhibited a gain of 0 dB; after correcting for the loss in the waveguide, the amplifier was found to afford a gain of 0.9 dB. In a test at 220 GHz, the overall gain of the amplifier-and-waveguide assembly was found to be 3.5 dB.

This work was done by Pekka Kangaslahti of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

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:

*Innovative Technology Assets Management
JPL*

*Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
E-mail: iaoffice@jpl.nasa.gov*

Refer to NPO-44393, volume and number of this NASA Tech Briefs issue, and the page number.

Multi-Stage System for Automatic Target Recognition

This system is capable of identifying hazards to avoid in robotic vehicle and automobile navigation.

NASA's Jet Propulsion Laboratory, Pasadena, California

A multi-stage automated target recognition (ATR) system has been designed to perform computer vision tasks with adequate proficiency in mimicking human vision. The system is able to detect, identify, and track targets of interest. Potential regions of interest (ROIs) are first identi-

fied by the detection stage using an Optimum Trade-off Maximum Average Correlation Height (OT-MACH) filter combined with a wavelet transform. False positives are then eliminated by the verification stage using feature extraction methods in conjunction with neural net-

works. Feature extraction transforms the ROIs using filtering and binning algorithms to create feature vectors. A feed-forward back-propagation neural network (NN) is then trained to classify each feature vector and to remove false positives. The system parameter optimiza-