

Discussion

The processor has completed its first 1½ years of usage without component failure. This indicates the high reliability of the relatively new MOS circuits. The characteristics of digital filtering, i.e., large output dynamic range, stability, high Q filters regardless of frequencies, uniformity of filter bin spacing and response, are all inherent in the processor. In addition, the high-speed operation of the DFA makes it especially useful for wideband digital processing of coherent radar signals and multiple channel sonar processing.

Its most used mode is to process analog inputs and send either raw or filtered data to a computer. The data then can undergo some additional modification prior to either storage, power spectra plotting, or direct lofargram generation. This arrangement places the digitizing and high speed

processing burden on the DFA with the control and lower order processing on the computer.

The analyzer reflects use of the medium scale integration circuits available at the time of construction. Using the latest technology, reclocked array arithmetic units can now operate at 18 MHz. MOS shift registers are now available at 20 MHz clocking rates. Therefore, a new implementation of the basic organization presented could result in a speed increase of seven and an improvement in the cost to computation rate ratio. Also, more parallelism could be incorporated into the design to increase speed even further. However, any new analyzer should be considered for the total system in which it is to be used. Preprocessing, postprocessing, and data handling factors already can readily overshadow the basic transform unit in cost and complexity.

PUBLICATIONS

Compilation of principal recently published books and technical articles written by APL staff members.

- K. Green, B. Hastings (The Johns Hopkins School of Medicine), and M. H. Friedman (APL), "Sodium Ion Binding in Isolated Corneal Stroma," *Amer. J. Physiology* **220**, No. 2, Feb. 1971, 520-525.
- A. G. Schulz, L. G. Knowles, L. C. Kohlenstein, and L. J. Maroglio, "A Digital Simulation of the Rectilinear Scanning Process," *Proc. Symp. on Sharing Computer Programs and Tech. in Radiation Therapy and Nuclear Medicine*, Oak Ridge, Tenn., Apr. 2-3, 1971.
- F. T. Fraunfelder (The Johns Hopkins School of Medicine), L. J. Viernstein (APL), "Intraocular Pressure Variation during Xenon and Ruby Laser Photocoagulation," *Am. J. Ophthalmology* **71**, No. 6, June 1971, 1261-1266.
- L. W. Ehrlich, "Solving the Biharmonic Equation as Coupled Finite Difference Equations," *SIAM, J. Numer. Anal.* **8**, No. 2, June 1971, 278-287.
- R. M. Fristrom, "The Chemistry of Polymer Flames—Propagation and Suppression," *Proc. Polymer Conference Series, Flammability Characteristics of Polymeric Materials*, Section 8; June 1971.
- R. C. Orth and H. B. Land, "A Production Type GC Analysis System for Light Gases," *J. Chromatographic Sci.* **9**, June 1971, 359-363.
- F. J. Adrian, "Contribution of $S_0 \leftrightarrow T_{\pm 1}$ Intersystem Crossing in Radical Pairs to Chemically Induced Nuclear and Electron Spin Polarizations," *Chem. Phys. Letters* **10**, No. 1, July 1, 1971, 70-74.
- T. P. Armstrong (Univ. of Kansas), S. M. Krimigis (APL), "Statistical Study of Solar Protons, Alpha Particles, and $Z \geq 3$ Nuclei in 1967-1968," *J. Geophys. Res.* **76**, No. 19, July 1, 1971, 4230-4244.
- J. R. Apel and T. O. Poehler (APL) and C. R. Westgate and R. I. Joseph (The Johns Hopkins University), "Study of the Shape of Cyclotron-Resonance Lines in Indium Antimonide Using a Far-Infrared Laser," *Phys. Rev. B* **4**, No. 2, July 15, 1971, 436-451.
- D. M. Silver, "Metric Evaluation in the Space of Exponential and Gaussian Functions," *Chem. Phys. Letters* **10**, No. 2, July 15, 1971, 227-229.
- M. H. Friedman (APL) and K. Green (The Johns Hopkins School of Medicine), "Ion Binding and Donnan Equilibria in Rabbit Corneal Stroma," *Amer. J. Physiology* **221**, No. 1, July 1971, 356-362.
- K. Green (The Johns Hopkins School of Medicine) and M. H. Friedman (APL), "Potassium and Calcium Binding in Corneal Stroma and the Effect on Sodium Binding," *Amer. J. Physiology* **221**, No. 1, July 1971, 363-367.
- B. E. Tossman, "Variable Parameter Nutation Damper for SAS-A," *J. Spacecraft and Rockets* **8**, No. 7, July 1971, 743-746.
- D. M. Silver, "Electron Pair Correlation: Products of $N(N-1)/2$ Geminals for N Electrons," *J. Chem. Phys.* **55**, No. 3, Aug. 1, 1971, 1461-1467.
- T. A. Potemra (APL) and L. J. Lanzerotti (Bell Tel. Labs.), "Equatorial and Precipitating Solar Protons in the Magnetosphere. 2. Riometer Observations," *J.*

PUBLICATIONS *(continued)*

- Geophys. Res.* **76**, No. 22, Aug. 1, 1971, 5244-5251.
- L. Monchick, "Estimates of Error Bounds of Gas Transport Properties. II. Polyatomic Gases," *J. Chem. Phys.* **55**, No. 4, Aug. 15, 1971, 1759-1762.
- T. O. Poehler, "Magnetic Freezeout and Impact Ionization in GaAs," *Phys. Rev. B* **4**, No. 4, Aug. 15, 1971, 1223-1229.
- R. A. Kropfli, "Simultaneous Radar and Instrumented Aircraft Observations in a Clear Air Turbulent Layer," *J. Appl. Meteorology* **10**, No. 4, Aug. 1971, 796-802.
- R. W. Flower and A. Patz (The Johns Hopkins School of Medicine), "The Effect of Hyperbaric Oxygenation on Retinal Ischemia," *Investigative Ophthalmology* **10**, No. 8, Aug. 1971, 605-616.
- D. W. Rabenhorst, "Potential Applications for the Superflywheel," *1971 Intersociety Energy Conversion Engineering Conference Proceedings*, P38, Aug. 1971, 1118-1125.
- J. P. Wagner, "Sea Water Battery Experiments," *1971 Intersociety Energy Conversion Engineering Conference Proceedings*, P38, Aug. 1971, 541-555.
- G. L. Dugger, A. Brandt, J. F. George, and L. L. Perini, "Flywheel and Flywheel/Heat Engine Hybrid Propulsion Systems for Low-Emission Vehicles," *1971 Intersociety Energy Conversion Engineering Conference Proceedings*, P38, Aug. 1971, 1126-1141.
- D. K. Anand, R. S. Yuhasz, J. M. Whisnant, "Attitude Motion in an Eccentric Orbit," *J. Spacecraft and Rockets* **8**, No. 8, Aug. 1971, 903-905.
- R. M. Fristrom, "Flame Inhibition Chemistry," *Proc. AGARD Conference No. 84 on Aircraft Fuels, Lubricants and Fire Safety*, Section 12; Aug. 1971.
- A. A. Westenberg, "Kinetics of NO and CO in Lean, Premixed Hydrocarbon-Air Flames," *Combustion Sci. and Tech.* **4**, No. 2, Aug. 1971, 59-64.
- G. Gebel (APL) and B. Matthews (Marconi Space and Defense Systems, Ltd., England), "Navigation at the Prime Meridian," *Navigation* **18**, No. 2, Summer 1971, 141-146.
- S. M. Krimigis (APL), E. C. Roelof (Univ. of New Hampshire), T. P. Armstrong (Univ. of Kansas), and J. A. Van Allen (Univ. of Iowa), "Low-Energy ($\cong 0.3$ Mev) Solar-Particle Observations at Widely Separated Points (> 0.1 AU) during 1967," *J. Geophys. Res.* **76**, No. 25, Sept. 1, 1971, 5921-5946.
- R. Turner and T. O. Poehler, "Characteristics of the HCN Laser Radiation at High-Excitation Currents," *J. Appl. Phys.* **42**, No. 10, Sept. 1971, 3819-3826.
- P. G. Fuechsel (APL), P. M. Bainum (Howard Univ.), and P. J. Grunberger, "Attitude Motion of a Nutationally Damped Dual-Spin Spacecraft in the Presence of Near-Earth Environment," *J. Spacecraft and Rockets* **8**, No. 9, Sept. 1971, 913-914.
- D. M. Silver, "Unified Treatment of Diatomic Electron Interaction Integrals over Slater-Type Atomic Orbitals," *J. Math. Phys.* **12**, No. 9, Sept. 1971, 1937-1943.
- W. G. Spohn, Jr., "On Conway's Conjecture for Integer Sets," *Canad. Math. Bull.* **14**, No. 3, Sept. 1971, 461-462.
- S. Anderson, "Computer Animation: A Survey," *J. Micrographics* **5**, No. 1, Sept.-Oct. 1971, 13-20.
- M. H. Friedman, "Application of Computer Experimentation to the Cornea," *Nature* **233**, No. 5321, Oct. 22, 1971, 553-555.

BOOK

Emerson Clarke (Zenith Radio Corp.) and Vernon Root (APL), "Your Future in Technical and Science Writing," Richards Rosen Press, Inc., New York, 1972.

HONORS AND AWARDS

The Applied Physics Laboratory was the recipient of an I-R Award sponsored by Industrial Research, Inc., for its work in developing the externally powered upper limb prosthetic system. This effort was in collaboration with the Johns Hopkins Medical Institutions.

G. L. Dugger, Supervisor of the Hypersonic Propulsion Group, has been named a Fellow of the American Institute of Aeronautics and Astronautics.

R. M. Hanes, a member of the

staff of the Engineering Psychology Research Group, is serving a two-year term as President of the Inter-Society Color Council.

APL COLLOQUIA

- Oct. 8 - "Man: Past, Present—Future?," by L. S. B. Leakey, National Museum, Nairobi, Kenya.
- Oct. 22 - "The 'Overselling' of the Physician," by H. M. Seidel, The Johns Hopkins University.
- Oct. 29 - "Urban Transit and Institutional Inertia," by J. C. Kohl, Commissioner of Transportation, New Jersey.

PATENTS

- J. L. James and H. H. Nall—*Missile Communications Link*, Patent No. 3,594,500.
- W. H. Avery—*Directional Warhead*, Patent No. 3,598,051.
- C. T. Pardoe—*Sequence Recognition System*, Patent No. 3,599,149.
- R. B. McDowell and R. V. Schreiber—*Method for Extracting Information Contained in a Signal Degraded by Noise*, Patent No. 3,599,155.
- E. J. Hoffman and R. M. Rhue—*Regenerative Tone Decoder*, Patent No. 3,604,945.
- E. F. Prozeller—*Duty-Cycle Phase Detector*, Patent No. 3,604,946.

ADDRESSES

Principal recent addresses made by APL staff members to groups and organizations outside the Laboratory.

T. A. Potemra (APL) and L. J. Lanzerotti (Bell Tel. Labs.), "Equatorial and Precipitating Polar Protons in the Magnetosphere and Riometer Observations during the 28 January 1967 Solar Event," *American Geophysical Union*, Washington, D.C., April 12-16, 1971.

M. H. Friedman, "A Quantitative Description of Equilibrium and Homeostatic Thickness Regulation in the In Vivo Cornea," *Sixth Annual Corneal Research Conference*, New York, June 12, 1971.

T. A. Potemra and A. J. Zmuda, "A Review of Solar Protons and their Effects on the D-Region during the PCA's in the Period 1961 to 1969," *COSPAR Symposium on D- and E-Region Ion Chemistry*, University of Illinois, Urbana, July 6-8, 1971.

The following four addresses were presented at the *XVth General Assembly of the International Union of Geodesy and Geophysics*, Moscow, USSR, August 2-14, 1971:

J. C. Armstrong, "Field Aligned Current Systems at Auroral Latitudes;"

S. M. Krimigis, "Trapped Nuclei with $Z \geq 2$: A Clue to the Origin of the Radiation Belts;"

A. J. Zmuda, "Status of Evaluations of the International Geomagnetic Reference Field 1965.0;"

A. J. Zmuda, M. L. Dworkin, and W. E. Radford, "Hydromagnetic Waves at 6.25 R_e ."

S. M. Krimigis, "Trapped Proton Spectra," *Max-Planck Institut für Physik und Astrophysik*, Munich, West Germany, August 2-5, 1971.

The following two papers were presented at the *1971 Intersociety Energy Conversion Engineering Conference*, Boston, August 3-6, 1971:

G. L. Dugger, F. C. Brandt, J. F. George, and L. L. Perini, "Flywheel and Flywheel Heat-Engine Propulsion Systems for Low-Emission Vehicles;"

J. P. Wagner, "Sea Water Battery Experiments."

L. J. Rueger, "One Way Time Dissemination from Low Altitude Satellites," *APL Amateur Radio Club*, Silver Spring, Maryland, August 13, 1971.

P. M. Bainum, P. G. Fuechsel, and J. V. Fedor, "Stability of a Dual-Spin Spacecraft with Energy Dissipation in a Flexible Momentum Wheel," *AAS/AIAA Astrodynamics Conference*, Ft. Lauderdale, Florida, August 17-19, 1971.

The following three papers were presented at the *Tenth International Symposium on Free Radicals*, Lyons, France, August 30-September 3, 1971:

F. J. Adrian, "Nuclear and Electron Spin Polarization via Diffusional Separation and Reencounter of Radical Pairs;"

A. A. Westenberg, "Gas Kinetics Using Electron Resonance;"

E. L. Cochran and F. J. Adrian, "ESR Study of the Pyrolysis of Hydrogen."

A. Michelsen, "Observations on the Relationship Between Radiation Induced Chromosome Aberrations and Exposure Rate for X-Rays," *Fourth International Congress on Human Genetics*, Paris, September 6-11, 1971.

The following three papers were presented at the *International Conference on Color Centers in Ionic Crystals*, University of Reading, Reading, England, September 6-10, 1971:

F. J. Adrian and A. N. Jette, "Theoretical Investigation of the Polarization and Band Intensities of the Optical Transitions of the V_K Center;"

D. Ikenberry and T. P. Das (University of Utah), and A. N. Jette (APL), "Origin of Negative Transferred Hyperfine Constants of V_K Centers in Ionic Crystals;"

A. N. Jette, "Second Order Spin-Orbit Contributions to the V_K Center Hyperfine Components."

The following two papers were presented at the *International Federa-*

tion of Automatic Control, Dubrovnik, Yugoslavia, September 6-10, 1971:

R. E. Fischell, "Spacecraft Attitude Control;"

R. E. Fischell and R. B. Kershner, "Attitude Control System for a Small Astronomy Satellite."

R. K. Frazer, "An Experiment to Correlate the Thermal Stress Failure Level to Modulus of Rupture in Ceramic Materials," *Second International Symposium on Electromagnetic Windows*, Paris, September 8-9, 1971.

D. G. Grant, R. A. Meyer, and D. A. Qualkinbush, "An Optical Phased Array Beam Steering Technique," *Electro-Optical Systems Design Conference*, New York, September 14-16, 1971.

R. A. Makofski, "Proposed Urban Transit Systems," *Society of Automotive Engineers, Mid-Continent Section*, Tulsa, September 23, 1971.

R. A. Makofski, "Innovative Mass Transit Systems," *Marquette University Mass Transit Planning and Engineering Lecture Series*, Milwaukee, September 28, 1971.

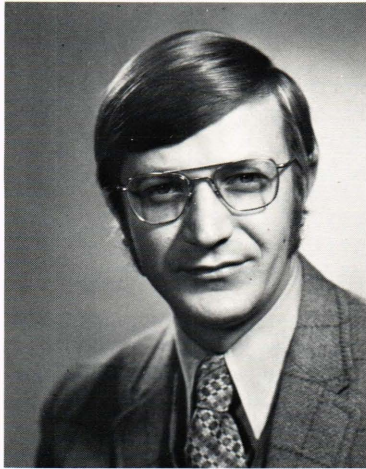
L. B. Weckesser and J. R. Kime, "A Sensor for Measuring Convective Heat Transfer Coefficient," *Eleventh International Conference on Thermal Conductivity*, Albuquerque, September 28-October 1, 1971.

S. M. Krimigis, "Low Energy Solar Particle Propagation Deduced from Multi-Spacecraft Observations," *University of Maryland Space Astrophysics Seminar*, College Park, October 4, 1971.

R. E. Walker, "Gas Tonometry," *University of Florida Department of Ophthalmology*, Gainesville, October 5, 1971.

A. M. Stone and H. D. Black, "Satellite Navigation," *A Series of Five NATO-AGARD Sponsored Lectures at the Italian War College*, Florence, Italy, October 25-31, 1971.

WITH THE AUTHORS



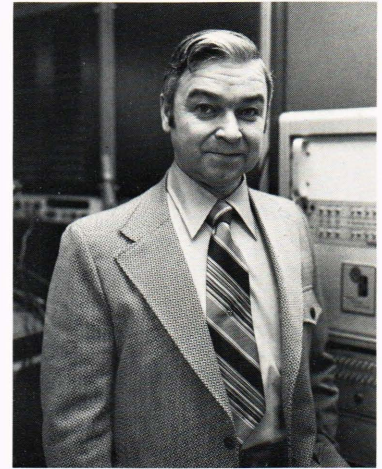
R. L. Appel, co-author of "A Time-Division Multiplexing System for Asynchronous High-Rate Telemetry," is a native of western New York and received the B.S.E.E. degree from the University of Detroit and the M.S.E.E. degree from the University of Illinois. A specialist in space communication systems and digital equipment design, he joined the Space Communications Group of APL in 1965, where he has been engaged in the design and analysis of digital and RF systems for the Manned Space Flight Network. Mr. Appel is currently involved in an analysis of the spacecraft antenna system for the High Energy Astronomical Observatory and is conducting an experimental study of equatorial ionospheric scintillation effects at the Lima, Peru, tracking station. He is a member of the Institute of Electrical and Electronics Engineers.

C. T. Pardoe, co-author of "A Time-Division Multiplexing System for Asynchronous High-Rate Telemetry," is a native of Maryland and received the B.S. degree in electrical



engineering from The Johns Hopkins University. A specialist in space communications and special-purpose digital hardware, he was employed by APL in 1961. Originally in the Adaptive Machines Group, Mr. Pardoe performed neuronal simulation studies on a special-purpose analog computer and developed time interval correlator equipment and a display system for the correlator. Since joining the Space Communications Group in 1969, he has been performing studies to determine the impact of the NASA Skylab Project on the Manned Space Flight Network and has developed special-purpose digital equipment for the Network.

A. M. Chwastyk, author of "A High-Speed Digital Fourier Analyzer," is a specialist in special-purpose digital computer organizations and designs. He is a native of New Jersey and has the B.S. degree in electrical engineering from Rutgers University. Mr. Chwastyk was first employed as a junior engineer at the Naval Gun Factory in Wash-



ington, D.C. and then as an electronics engineer at the Naval Ordnance Laboratory. He joined APL in 1957, was first assigned to the Instrumentation Development Group, and then transferred to the Typhon Weapon Program where he worked on such tasks as the design of a special-purpose real-time computer and design and development of an experimental optical data processor. For the past seven years Mr. Chwastyk has been a Project Supervisor in the Missile Radar Techniques Group where he has been involved in such assignments as the design and construction of a digital equipment for radar signal processing and clutter experiments and real-time programming of a general purpose computer for radar system control and analysis. Recently he has been responsible for the design and construction of the Fast Fourier Transform unit and its incorporation into a sonar processing system. He is now involved in the planning and development of a high-capability sonar processing laboratory.