Abstracts of Papers From Other Journals

Abstracts of papers appearing in other journals chosen for their importance and possible value to researchers, as well as those of timely interest, are published in the *Journal* from time to time.

Subject areas for the Abstracts in this issue of the *Journal* are shown below:

Laboratory Practice
Optics
Photographic Theory and Materials
Sound
Television

LABORATORY PRACTICE

Cutting Between the Dotted Lines: Film Slitting in the Laboratory, A. J. Iles, *BKSTS J., 60:* 178-182, July 1978.

Processing laboratories have been slitting film down to narrower formats for many years, but there is a danger that the present machinery and understanding may fall short of quality requirements as the volume of critical work on sophisticated narrow-width formats continues to increase.

Film stock manufacturers have been slitting film from wide rolls since the introduction of flexible base. There has been a continuous development of the technology, particularly in the last ten years with the latest generation of color films.

Now it seems to be an appropriate time to consider some of the techniques and lessons learned in manufacture which can be applied to the laboratory slitting-down process.

This paper reviews the various requirements of the process, outlines the theory of slitting and some of the methods used in manufacture, and considers a theoretical ideal slitting machine for laboratory operations.

OPTICS

Extending the Content and Expanding the Usefulness of the Simple Gaussian Lens Equations, L. T. Sachtleben, *RCA Review, 37:* 437-472, Dec. 1976.

The two classical, simple Gaussian lens equations relate four variables; this study extends them to three equations and adds a fifth, composite variable. The equations are stabilized and kept analytically manageable by adopting a purely optical sign convention proposed by Gardner. A table presents complete solutions of the three equations. Further usefulness of the equations is developed by applying them to the case of two separated lenses, or systems in air or vacuum. Partial solutions are derived, and a few representative two-lens applications are developed. General use of the solutions is simplified by a transformation. The extended equations are useful in planning new systems and in analyzing and further developing an existing or proposed system. Their use may precede or accompany considerations of both photometry and computer-programmed correction of aberrations. They are not useful in the case of systems such as high-speed spherical condensers, whose aberrations though minimized or otherwise adjusted will remain large and uncorrected.

A High Resolution Analog Fiber Optics Data Communications System, Gary J. Grimes and David R. Stevens, *Opt. Eng., 17:* 425-431, July-Aug. 1978.

A high-resolution fiber optics communication system (FOCS) for analog signals has been designed, built, and tested at the Frank J. Seiler Research Laboratory, USAF Academy, Colorado. The FOCS consists of a small transmitter and receiver pair and an optical waveguide. A combination of voltage-to-voltage (V/F/V) and pulse width modulation (PWM) is used to reconstruct a ±10-volt analog output signal from an identical ±10-volt analog input signal. A digital output is easily obtained since the data transmission is pulsed. The FOCS is equally applicable to free-space infrared communications. The advantages of fiber optics have not previously been available for general-purpose data acquisition because their application has been limited to dedicated digital systems and to low-resolution, high-frequency video systems. Data collected on a very general V/F/V system are presented to give the designer information on V/F/V system dynamics at frequencies much higher than those considered to be in the V/F/V system's useful range for data acquisition and communication purposes. These data show that the V/F/V process may be useful for servo-loop applications at much higher frequencies than it is for data acquisition and communication applications.

PHOTOGRAPHIC THEORY AND MATERIALS

A Rotary Reflective Polygon (Image Immobilizer), Ulrich M. Fritzler, *BKSTS Journal, 60:* 6-10, January 1978.

Various methods have been used to produce optical immobilization in projection since the beginning of motion pictures, but few have survived to compete with the intermittent movement.

The drawbacks of the intermittent movement are well known and when these are considered in detail, it is surprising that so few optical projection systems are available.

The reasons lie not only in the design problems of optical image immobilizers but also in the cost of producing them in volume, in the need for highly trained personnel in manufacture and later on for maintenance. Furthermore there is the question as to whether a system has long-term reliability.

Development of the solid glass polygon found in editing tables has centered on two improved optical compensators -- refractive and reflective. Limitations of such systems are the lay back focus requirement, small image size, poor light efficiency, dynamic keystoring, tracking errors and aberrations, etc.

Recognizing these problems it was established that an ideal design for an optical image immobilizer should consist of a single self-aligned optical component comprising a mirror-drum formed from two polygon halves facing each other at 90°, with a permanently attached sprocket wheel, so that the film and the sprocket wheel turn in unison with the reflective drum (isotransport).

This concept has been developed as the Hollogon "Reflective Skanner."

Decision Theory and the Detail Signal-to-Noise Ratio of Otto Schade, Robert F. Wagner, *Phot. Sci. Eng., 22:* 41-46, Jan./Feb. 1978.

The summary measures of image quality used by Otto Schade are really quite fundamental in nature. Previously the connection between the noise equivalent passband N_e and photographic acutance has been pointed out. Here we derive Schades detail Signal-to-Noise Ratio from statistical decision theory for the case of Gaussian objects and spread functions in the presence of Gaussian noise, which may be colored by the spread functions; also for the case of the standard three-bar resolution target in the same context.

Real-Time Spatial Modulators for Optical/Digital Processing Systems, Donald S. Oliver, *Opt. Eng., 17:* 288-294, May-June 1978.

The real-time functional features of optically addressed electro-optical spatial modulators such as the Pockels Readout Optical Modulator (PROM) are described and applied to hybrid optical/digital processing of photographic information. The current and predicted performance of developed hardware and R&D devices for optical image sampling, incoherent-to-coherent conversion, stored image manipulation and computer-controlled Fourier plane filtering are presented. The utility in image exploitation of adjusting the dynamic range of a stored image under interactive computer control to effect background suppression, optical density level contouring, image inversion, spatial filtering and edge enhancement is illustrated graphically.

The PROM — A Status Report, Robert A. Sprague and Peter Nisenson, *Opt. Eng., 17:* 256-266, May-June 1978.

The Pockels Readout Optical Modulator is a solid-state, rapidly recyclable image storage device having a number of applications in image and signal processing. Some of its important characteristics include $\frac{1}{10}$-wave optical surface quality, 100-lp/mm three-bar resolution, 10 ergs/cm^2 light sensitivity, and image plane contrast of 10^4:1. One of the unique features of the PROM is that the bias level of stored patterns can be adjusted through application of an external voltage, resulting in image contrast inversion or enhancement. This same operation (baseline subtraction) is used to null the zero order in an optical Fourier transform, achieving a Fourier plane signal-to-noise ratio approaching 10^6:1. This paper reports on the current status of this device and a number of applications for which it has been tested in several areas of image and signal processing. Results are shown for coherent optical processing by computer-controlled Fourier plane filtering and real-time image correlation. Signal processing systems are described which couple the PROM with an acousto-optic raster recorder to perform spectrum analysis and correlation on radio frequency signals.

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The award to Eastman Kodak Company from the Academy of Motion Picture Arts and Sciences is particularly gratifying to us, because Eastman 5243 film is the film "almost no one ever sees." As an intermediate film intended for making color master positives and color duplicating negatives, it is an *essential* element in getting the final picture on the screen.

Kodak now makes more than thirty professional motion picture films. Our search for improved motion picture technology is part of our commitment to the industry.

We set out to give filmmakers a way to produce color duplicate negatives with improved quality. This recognition by the Academy, as well as the satisfaction of our customers, is indeed rewarding.

We thought you'd like to read the opinion of some others in our industry.

Frank Van der Veer, A.S.C.
President, Van der Veer Photo Effects.

"It's very annoying to send a lemon commercial to the lab and get it back looking like oranges. What makes Eastman 5243 film so helpful to all of us in the photo effects business is that it is about as true to color as you can get. You don't have to keep fiddling around to try and get face tones and objects looking right without sacrificing one or the other. The color you have in the original negative is the color you have in the duplicating negative.

"The grain is almost non-existent, and that is important because often we have to blow up the original.

"I like the definition, the crispness and mainly the dependability. We try hard to arrange it so as to wind up with as few generations as possible but sometimes a number of them is unavoidable. If there were any problem areas they would multiply, and it would be most noticeable in going from original negative to dupe.

"Eastman 5243 film doesn't surprise you in the viewing room. It does its job quietly and very efficiently."

Linwood G. Dunn, A.S.C., Ph.D.
Founder and President of Film Effects of Hollywood, and President of the American Society of Cinematographers.

"Kodak color intermediate II film 5243 is the film we now use to make duplicate color negatives... which are almost never noticed. Because of this achievement, I call 5243 intermediate the 'unsung hero' of film stocks, as it really helps us to realistically put our magic into movies. We can now retain in our special effects the color fidelity, sharpness and overall quality of the original photography through the duplication process without the risk of excessive handling of the original negative. We intercut 5243 optical effects next to the original negative, and you don't notice a change in screen quality. Without such a tool, the illusion we are trying to create could easily be destroyed.

"Two more important points: First, you can make a 5243 protection master of the entire production to store in a vault, thus substantially reducing insurance costs. Second, because of its increased film speed, the 5243 intermediate film is much more suitable for emulsion-to-emulsion contact printing, thus dramatically reducing transfer of any surface abrasions and imperfections from the original negatives that would be visible through the optical printing step required for the color reversal duplication system.

"As a member of the Scientific and Technical Awards Committee of the Motion Picture Academy, I strongly supported the award given Eastman Kodak Company for scientific achievement in its development of the 5243 intermediate, 'The magic film that nobody sees.'"

Robert Blalack
President, Motion Pictures, Inc. Oscar Award-Winner for Visual Effects on "Star Wars."

"When you want top screen quality in optical effects, you tackle all the components involved in the optical process—illumination, lenses, color separations and matte stocks. And then all your efforts end up on the dupe negative stock.

"Kodak asked me to test this stock just as *Star Wars* was getting under way. The results were impressive. Our travelling matte opticals became extremely sharp, and that added a new realism.

"The minimal grain and clear colors give you the feeling you are right there. Eastman 5243 film made a definite contribution to winning the Oscar.

"Eastman 5243 film is one full stop faster than its predecessor. That's an added plus, particularly when you are compositing from color separations, as I did in *Star Wars*.

"We had some scenes in *Star Wars* that were made up of 72 pieces of film—mattes, separations and intermediates. Every one of them was made on one of the vast selection of Kodak film stocks. But the stock that had to finally carry the ball was 5243.

"At Motion Pictures, Incorporated, we are committed to no-compromise, top-quality visual effects. And one key decision we have made—from experience—is to use the diverse and useful family of films from Kodak, of which Eastman 5243 film is a welcome newcomer."

If you would like to know more about Eastman color intermediate II film 5243, ask your Kodak sales and engineering representative at one of the offices listed below.

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ROCHESTER: 716/254-1300
SAN FRANCISCO: 415/776-6055
WASH., D.C.: 202/554-9300

Kodak... Official motion picture consultant to the 1980 Olympic Winter Games.

Comparison of Coherent and Incoherent Optical Spectrum Analysis Techniques in Image Evaluation, Scott A. Armstrong and Brian J. Thompson, *Opt. Eng., 17:* 273-279, May-June 1978.

The application of communication theory and linear systems concepts to the analysis of photographic images and imaging systems is well established. These techniques include the use of the Wiener spectrum to characterize photographic granularity and to determine the transfer functions for photographic imaging and printing; the standard methods of measurement that have been developed use essentially incoherent optical techniques. Recently, however, coherent optical processors have been applied to image analysis. A series of experiments is described which allows comparison of the spectra and the transfer functions generated by the incoherent and the coherent techniques.

Photoconductor-Thermoplastic Image Transducer, W. S. Colburn and B. J. Chang, *Opt. Eng., 17:* 334-343, July-Aug. 1978.

The photoconductor-thermoplastic, or photoplastic, recording medium can serve as an incoherent-to-coherent transducer to insert data into a coherent optical processor in real time. The photoplastic transducer is characterized by good exposure sensitivity, high resolution, and simple construction, and it is well suited to applications requiring image retention before and during readout. In our investigations we measured exposure sensitivities of less than 50 ergs/cm^2, and achieved a write cycle of charge, expose, and develop in less than 10 msec. Because of the band-pass nature of the recording medium, a spatial frequency offset was provided by overlaying the image with a grating. Images were recorded with incoherent light and read out with coherent light with good fidelity, and the transducer was tested as the input to a matched filter processor.

SOUND

Some Criteria for the Selection for Sampling Rates in Digital Audio Systems, Alastair Heaslett, *Jour. Aud. Eng. Soc., 26:* 66-70, Jan./Feb. 1978.

The author discusses the major balancing factors affecting the choice of sampling frequency and its relationship to television and film systems.

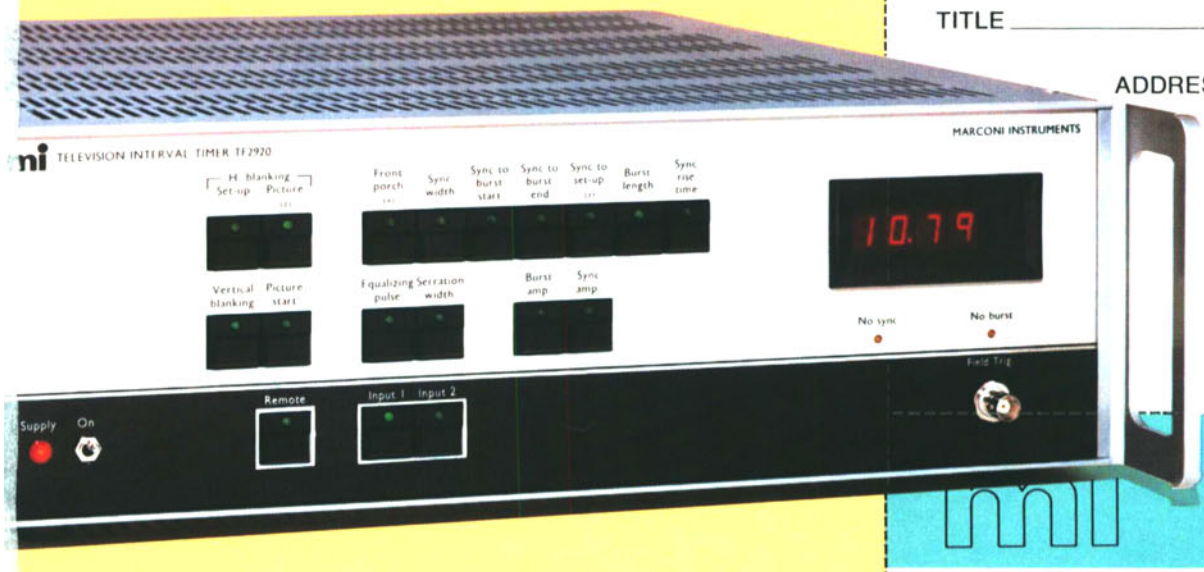
A Review of Digital Audio Techniques, Martin Willcocks, *Jour. Aud. Eng. Soc., 26:* 56-64, Jan./Feb. 1978.

Existing digital audio systems are discussed, and a tabulation is made of manufacturers' data, including type of system, sampling rate, encoding format, and number of channels. Also covered is the organization of data into blocks, choice of block size for compatibility with frame periods for motion-picture, PAL and NTSC television soundtracks, and choice of a clock frequency. Forty references are included.

Sampling Frequency Considerations, Robert J. Youngquist, *Jour. Aud. Eng. Soc., 26:* 54, Jan./Feb. 1978.

A brief insight is given into some of the trade-offs considered in determining the sampling rate for a digital audio system.

Problems With 'H' & 'V' Blanking Measurements



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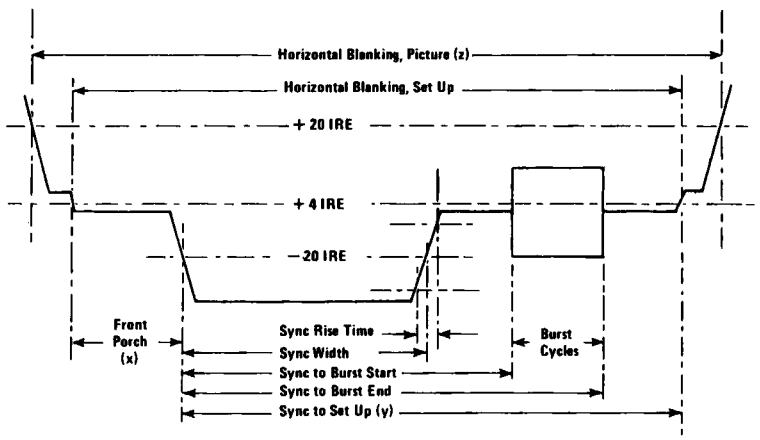
- Picture Blanking (+20 IRE), (z)
- Front Porch, (x)
- Sync Width
- Sync to Burst Start
- Sync to Burst End
- Sync to Set-Up, (y)
- Burst Length
- Sync Rise Time

VERTICAL BLANKING MEASUREMENTS
- Total Vertical Blanking Interval
- Picture Start
- Equalizing Pulse Width
- Serration Width

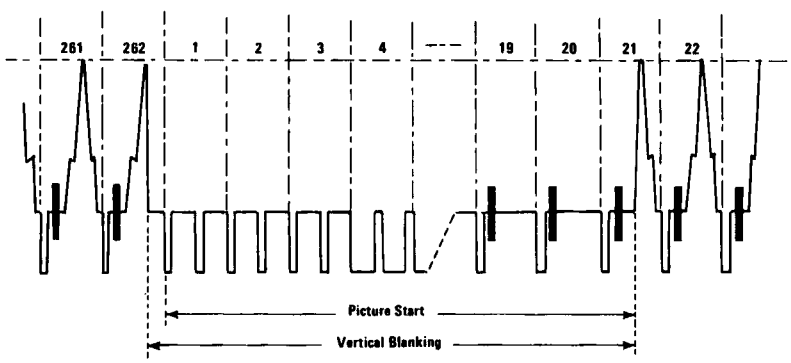
REFERENCE MEASUREMENTS
- Burst Amplitude in IRE
- Sync Amplitude in IRE

BCD OUTPUT for print-out on rear panel.

NTSC Model measures all of the above, other models as appropriate to Transmission Standard.



HORIZONTAL BLANKING INTERVAL



VERTICAL BLANKING INTERVAL

Flanging and Phasers, W. M. Hartmann, *J. Audio Eng. Soc., 26:* 439–443, June 1978.

The techniques of flanging (signal + delayed signal) and processing with a phaser (signal + all-pass filtered signal) are discussed. The considerable differences between the results of the two techniques are noted. It is shown that in the limit of an infinite number of one-pole all-pass stages processing with a phaser can become equivalent to flanging. It is shown that for a finite number of stages a phaser is optimized if all stages have the same time constant. In that case the peaks and zeros of the transfer function are most uniformly distributed in frequency.

TELEVISION

Digital Sound and Television Sampling-Rate Changing, A. H. Jones, *EBU Review, 163:* 127–136, June 1977.

One interfacing problem in digital television that standards committees are working rapidly to overcome is that of sampling-rate changing. This paper gives the results of a preliminary study, outlines the basic principles of sampling-rate changing, and examines a number of factors influencing the design of equipment. Particular topics covered include: time-quantization of the interpolation function, the use of synchronizer equipment, suppression of straight beat between input and output sampling rates, an example of the analysis of a sampling-rate changing interpolator, permissible level of unwanted components, relationship between complexity and cost, optimization of parameters, the analog interface, and signal-to-noise ratio. Relevant reports and documents are cited and a short glossary is given.

The New EBU Reference Tapes for Television Tape Machines, P. N. Kelly, *EBU Review: Technical Part,* 176–185, No. 164, Aug. 1977.

After reviewing the history of the problem, the author discusses the reasons that led to the production of two types of reference tape for the verification of the operation of transverse-track television tape machines — the primary reference tape and the alignment tape. He lists the principal characteristics that can be measured using the individual test signals and describes the signals that are recorded on the two types of reference tape. He summarizes the studies and the discussions that determined the choice of these signals. A description of the method of use of the reference tapes and of the various adjustments and verifications that can be made on television tape machines concludes the article.

Automatic Operation of the BBC's Transmission Network, D. East, I. J. Shelley, and G. C. Wands, *BBC Eng., No. 109:* 7–15, Apr. 1978.

Considerable progress has been made towards fully automatic operation of the BBC's transmitter networks. Monitoring and Information Centres are an important part of this progress, and the article describes how a small number of staff at these Centres, together with automatic control and monitoring equipment at the individual stations, supervise the operation of a large number of transmitting stations. The early-morning Open University television programs are radiated without any staff at any point in the broadcasting chain, from VTR source to transmitter.