Forum

Radiometry and Photometry

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An example of good usage of nomenclature

In the November/December 1979 *Optical Engineering* (page SR-164) is a review of the book *Radiometric Calibration: Theory and Methods* by Professor Clair L. Wyatt. I was especially impressed by Wyatt's use of the nomenclature that I have been advocating for the last six years:

Pointance: pertaining to a point source
Areance: to or from an area
Sterance: pertaining to a solid angle (steradian)

Shown here is a table taken from Wyatt's book together with an example of his lucid descriptive style.

3-2 Entities based on flux, area, and solid angle

"The units given in Table 3-2, which lists the radiometric entities of interest, are based on the elementary concepts of flux, area, and solid angle.

"*Flux* is defined as any quantity that is propagated or spatially distributed according to the laws of geometry or the geometry of radiation (phluometry). Examples are radiant energy, radiant power, visible light or luminous flux, electromagnetic quanta or photons, spectral radiant power, entropy, etc. The subscripts e, v, p, used in Table 3-2 refer to energy rate (watts), visible (lumen), and photon (quanta) flux, respectively, and are often not used when it is clear from the context in which they appear.[9]

"In phluometry the most complete and basic function is the geometrical distribution of flux with respect to position and direction—the flux per unit projected area and solid angle (flux per square meter steradian), or flux per unit throughput (Φ/T). The CIE standard retained the terms 'radiance' (watts per square meter steradian) and 'luminance' (lumen per square meter steradian) and provide no equivalent term for photon flux. Jones suggested the general term *sterance* which by the use of suitable modifiers may be made to apply to any flux. Thus *radiance* becomes *radiant sterance, luminance* becomes *luminous sterance,* and the photon quantity for which no term is given becomes *photon sterance.*

"The *average sterance [radiance, luminance]* L_{av} of a source is the ratio of the total flux to the product of the projected area and the solid angle. The limiting value of the average sterance as both area and solid angle are reduced is the sterance L at a point in a direction. The sterance is a measure of the flux of a source per unit area per unit solid angle in a particular direction, and is $L = d^2\Phi/(d\omega \cos\theta dA) = d\Phi/dT$ which has the units of flux per square meter steradian.

"It is implicit in the definition of sterance that the area is taken as the projected area of the source in the direction that the radiation is directed or being measured. This allows a meaningful measure of the sterance when the source area is not known. If the projected area is used, rather than the real area, the sterance is independent of direction for sources that obey Lambert's cosine law.

"The geometrical distribution of flux with respect to position (surface) is the flux per unit area (flux per square meter). The CIE standard includes two entities to differentiate between emitted and incident flux. Emitted flux is given the general term of *exitance* which is modified to provide *radiant exitance* and *luminous exitance.* The terms of *irradiance* and *illumination* are retained in the CIE standard for incident flux. The general term *incidance* was suggested by Jones[8] for incident flux. However, the term *areance* has more recently been suggested [7, pp. G183-G187] as a general term for emitted and incident flux. Thus *radiant exitance* would be *radiant areance;* also irradiance would be *radiant areance.*

"The *average areance [exitance]* M_{av} of a source is the ratio of the total radiant flux Φ to the total area of the source. However, the limiting value of the average areance of a small portion of the source as the area is reduced to a point is the *areance* M of the source at a point. The areance is the measure of the flux radiated into a hemisphere per unit area of the source, and is the flux radiated into a hemisphere per unit area of the source, and is $M = d\Phi/dA$ where A is the area and M has the units of flux per square meter.

"The *average areance [irradiance, illuminance]* E_{av} is the ratio of the total flux to the total area of the incident surface, and is a measure of the flux per unit area incident on a surface. The limiting value of the average areance, as the area is reduced to a point, is the *areance* E at that point. The areance is a measure of the incident flux per unit area of surface and is $E = d\Phi/dA$, where A is the area and E

Table 3-2. Basic Radiometric and Photometric Entities

Terms[a]	Symbols	Units
Flux (watts, lumens, quanta, etc.)	Φ	Φ
Radiant flux (watts)	Φ_e	W
Luminous flux (lumens)	Φ_v	1m
Photon flux (quanta per second)	Φ_p	q sec^{-1}
Sterance [—] (positional-directional)	L	Φm^{-2}sr^{-1}
Radiant sterance [radiance]	L_e	W m^{-2}sr^{-1}
Luminous sterance [luminance]	L_v	1m m^{-2}sr^{-1}
Photon sterance[b] [—]	L_p	q sec^{-1}m^{-2}sr^{-1}
Areance [exitance] (positional)	M	Φm^{-2}
Radiant areance [radiant exitance]	M_e	W m^{-2}
Luminous areance [luminous exitance]	M_v	1m m^{-2}
Photon areance [—]	M_p	q sec^{-1}m^{-2}
Areance [—](positional)	E	Φm^{-2}
Radiant areance [irradiance]	E_e	W m^{-2}
Luminous areance [illuminance]	E_v	1m m^{-2}
Photon areance [—]	E_p	q sec^{-1}m^{-2}
Pointance [intensity] (directional)	I	Φ sr^{-1}
Radiant pointance [radiant intensity]	I_e	W sr^{-1}
Luminous pointance [luminous intensity]	I_v	1m sr^{-1}
Photon pointance [—]	I_p	q sec^{-1}sr^{-1}

[a] Dashes represent missing terms in the CIE nomenclature.
[b] The Rayleigh is also a measure of photon sterance (see Section 3-10).

has the units of flux per square meter.

"The geometrical distribution of flux with respect to direction is flux per unit solid angle (flux per steradian). The CIE standard retains the term *intensity* which has been objected to on the grounds that it has so many other meanings.[10] The term *pointance* has been suggested as a general term [7, pp. G183-G-187]. Thus *radiant intensity* becomes *radiant pointance.*

"The *average pointance [intensity]* I_{av} of a source is the ratio of the total flux radiated by a source to the total angle about the source. For an isotropic source (radiating equally in all directions), the flux is radiated into 4π sr (into a sphere) and for a flat surface, the flux is radiated into 2π sr (into a hemisphere). The limiting value of the average pointance, as the solid angle is reduced in value about a particular direction, is the *pointance* I in that direction. Pointance is a measure of the flux radiated by a source per unit solid angle in a particular direction, and is $I = d\Phi/d\omega$, where ω is the solid angle and I has the units of flux per steradian."

Note that, although Wyatt uses the nomenclature I prefer, he does not ignore the (CIE) names others have used. He defines sterance with radiance and luminance following in square brackets, as sterance [radiance, luminance] L, equals, etc. Thus, anyone working exclusively in the visible will know that sterance (preferred) and luminance are interchangeable, and have the units of flux $m^{-2}sr^{-1}$.

The geometry-radiometry relationships are used repeatedly throughout the book until it becomes quite obvious to the reader that the geometrical terms are almost self-defining, and that this usage considerably simplifies the explanations of calibration techniques.

In addition to the use of (preferred) nomenclature, the book has many commendable features. I especially like his use of complete units after each equation. As I stated in my book review, I predict that the book will become the standard for radiometric calibration in the measurement community and should be in everyone's library.

Digital image processing: the end of the home-builts

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When John Caulfield asked me to write some columns for *Optical Engineering,* I accepted without much thought. After all, it sounded like fun; and anyway, what academic has ever been able to resist the opportunity to write something that could be as opinionated as a column? The job has turned out to be a lot tougher than I thought, particularly the problem of selecting an appropriate topic. After considerable indecision I finally chose as my first column the topic "Digital Image Processing: the end of the home-builts."

When digital image processing was still in the stages of infancy, it was principally an activity restricted to a small number of governmental and university research laboratories. In this time frame, approximately 1965 to 1970, each research group solved the problems it encountered in its own idiosyncratic way. In particular, equipment for image processing was either built by the research group (as in most universities) or built by a private-industry contractor for the research group (as was the case for most government labs). In either event the equipment facilities available to a given research group were "one of a kind." Whatever equipment Laboratory A possessed was usually distinct (and usually incompatible) with the equipment in Laboratory B.

The "one-of-a-kind" nature of image processing equipment began to change around 1970. Several entrepeneurs had sufficient foresight and courage (or were sufficiently foolhardy and lucky) to believe that research, development, and applications of digital image processing would grow, and that the market for image processing equipment would grow equivalently. Their judgment was right. Today, digital image processing is not just an activity of research in government and industry. It is also a growing assortment of corporations offering hardware, software, and services. In short, it is an industry. By most American corporate standards it is still a small industry, but a continually growing and changing industry.

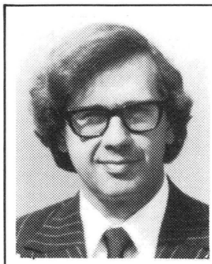
The variety of image processing hardware available today is so great that almost no laboratory needs to resort to "home-built" equipment. For example, image scanners and digitizers are available from several different vendors with a variety of characteristics, e.g., flat-bed scanners, rotating drum scanners, and flying-spot scanners. The scanners can be purchased either as stand-alone systems or as an exotic peripheral device that interfaces directly to a host computer.

Image display units are available from a wide variety of vendors, and have undergone such evolution as to require classification into two types of displays. "Hard-copy" displays produce a permanent image record on film, and the variety of hard-copy displays is as diverse as the variety of image scanner/digitizer devices. In fact, most image scanners can be made into hard-copy devices with some minor electrical and optical modifications. On the other hand, "soft-copy" displays present an image on a CRT that is directly viewed (and hence not a permanent record).

In soft-copy displays the evolution of equipment sophistication is most directly visible. Initially soft-copy displays were no more complex than a CRT and digital refresh memory which supplied the CRT image through a set of video digital-to-analog converters. The second generation of soft-copy displays integrated microprocessors, firmware, and reloadable look-up tables to enable substantial single-pixel image processing operations in the display. The third generation of displays is currently emerging and finds even more significant image processing operations integrated in the display. Convolution, image-to-image combination (add, multiply), histogram, zoom, scroll are just a few of the capabilities being offered in the more powerful image displays. Display systems *per se* are now passe; current systems emphasize the integration of display *and processing* into a single device, with more power at less overall cost to the user.

The point that should not be missed is that all these developments in available equipment would *not* have taken place if digital image processing were uninteresting as an economic activity for the technical entrepeneur. Perhaps that is a point that we in the academic world would find easy to miss. The proliferation of image processing equipment has made our academic research more fruitful, exciting and certainly easier. But academic research is a pitifully small market on which to base the developments that have occurred in the image processing equipment market. It is a growing market in government and private industry (worldwide, it should be noted) that has spurred industry to undertake the developments of equipment. For those equipment developments, I'm truly grateful. As an undergraduate my most notable effort in the lab was the near electrocution of a lab teaching assistant. If I had to rely today upon my own "home-built" efforts to do image processing, I'd have to get into another line of work—like washing cars or something else suited to my aptitude.

The Business Side of Optics



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Annual summary and where do we go from here?

This column has utilized inputs from a variety of people contributing papers to various SPIE seminars. It can continue this way if you like, but if you think a change is in order, you should respond with your concepts, suggestions, or offers to contribute something of optical business significance to this column. Please respond to the address given above with your comments.

We feel it is healthy to reevaluate where we have been and where we are going during 1980. There are a number of directions this column can go such as questions and answers, problem solving, further extension and development of management tools, technology forecasting, market research information surveys, or something specific you might desire for your business usage. It would be good to have a number of new contributors covering additional subjects pertaining to the optics industry. If there are no significant suggestions, several papers given at the last Huntsville Symposium will be utilized in the next few issues. The editor and I will, with your inputs, determine our direction for subsequent months. The following is a summary of articles which have appeared during the last year in this column. I hope you will use these existing articles as a base from which to make suggestions for 1980.

Management Strategy for High Technology Small Business, by Curt Deckert, President, Curt Deckert Associates, Inc., *Optical Engineering* 18:1 January/February 1979.

Strategy is defined as a multiple-step approach to achieve objectives or measurable goals involving coordinated use of personnel, assets and resources covering a specific time period consistent with that of objectives and plans. In business, opportunity is developed by intelligent thinking—not hasty action; bold calculation—not arbitrary decision; and strategic action—not brute force. Everyone can gain from strategy development since it attempts the deployment of the minimum resources for the maximum return. Most businesses have times where the resultant outcome is uncertain. The added confidence of a well thought out strategy can give encouragement to leaders to move more efficiently and confidently. Strategy is not a flash of genius but is developed from a well thought out plan for action and becomes an integral part of management policy. Proficiency in strategy should be attained with proper documentation describing specific strategic action for particular encounters or situations. Strategy not only has the ability to make an organization successful, but it is also needed for growth, stability, and even survival.

Your Yearly Patent Checkup—Diagnosing Your Latent Patent Illnesses, by Robert B. Hughes, Patent Attorney, Hughes & May, Sumas, Washington, *Optical Engineering* 18:2, March/April 1979.

This paper takes you through a series of questions to diagnose your latent patent ailments. It places you in one of three "risk" categories and then gives a "patent-fitness" test. If you end up in a high risk category with a low patent-fitness rating, it is hoped this will give you the motivation to adopt a healthy patent program.

In writing this paper the author makes two assumptions: first, you are interested in incorporating new technology into your products; second, you don't want to become experts in patent law, but would rather find out as quickly and painlessly as possible only what you need to know to keep out of trouble.

A healthy patent program can have something of the same effect. The whole purpose of patents is to stimulate creativity. This happens when your scientists and engineers are regularly exposed to an active patent program where they are reviewing newly issued patents of other companies, looking at patentability searches, and maybe even having a patent application filed. All of this contributes to an atmosphere of inventiveness and creativity which can do nothing but help the company's operation.

Management Evaluation of New Product Ideas, by Milton D. Rosenau, Jr., President, Rosenau Consulting Company, Santa Monica, California, *Optical Engineering* 18:3, May/June 1979.

Companies embark on new product development (NPD) for a variety of reasons. The evaluation of new product ideas must begin with an understanding of the underlying stimulus. After the rationale for NPD is clear, the central issues confronting management are to determine whether the new product can be made and, if so, whether the effort is worthwhile. Because product development issues tend to be so common in undertaking product development, it is frequently possible to use a checklist to focus critical thinking. It is clear that each company has special situations so no single checklist can address all the critical issues which fit these specialized situations. The following skeleton of a checklist which is presented by this article is a useful one which can be fleshed out by practitioners of NPD to best suit their own needs.

I. Can it be made?
- A. Fundamental principles
- B. Design
  1. Are the specifications complete?
  2. Does it meet all market requirements?
  3. Can it be tested, verified, inspected?
  4. Can it be packaged, stored, distributed?
  5. Is it convenient to use, well styled?
  6. Does it violate any patents?
  7. Do we have the required technical skills? Enthusiasm? Leadership?
- C. Manufacture
  1. Are tolerances reasonable?
  2. Are there multiple sources of supply?
  3. Are people, tooling, space available?
  4. Can cost targets be met?

II. Can it be sold at a profit?
- A. Cost
- B. Price
  1. Is there a real market?
  2. What is the competition?

Successful Management of New Optical Fabrication Projects, by E. P. Wallerstein, University of California, Lawrence Livermore Laboratory, Livermore, California, *Optical Engineering* 18:4, July/August

In the business of high precision optical components, certain characteristic difficulties are frequently encountered such as misinterpretation of specifications, erratic pricing, late bids, inability to perform, economic losses, and late deliveries. Problems may be expected in state-of-the-art optical fabrication projects but should be reduced through the application of the following management principles:

1. Assessment of relative capabilities within the industry;
2. Clarification of project requirements through discussion with customer prior to submitting proposal;
3. Codified baseline pricing guidelines from which to make pricing decisions;
4. Radical review of project at time of order;
5. Establishment and monitoring of procedures and milestones;
6. Open, knowledgeable, and objective communication with customer when questions or difficulties arise.

Again, the three areas of concern are specification, schedule, and cost. Frequent communications with the customer to ask questions, report progress, and realistically assess problem areas can be of enormous benefit to both parties. Identifying problems as soon as they arise can benefit both parties in several ways.

Management Controls for High Technology Programs, by Ernest A. Kuonen, Program Manager, Lasers, United Technologies Research Center, and Sawyer Thompson, Jr., Operations Program Manager, Pratt & Whitney Aircraft, West Palm Beach, Florida, *Optical Engineering* 18:5, September/ October 1979.

The article discusses a management system that provides improved management visibility, flexibility, and control that was adapted to major programs at Pratt & Whitney. An important element of the system is the establishment of management reserves in budget and schedule to offset the risks associated with development unknowns. Program tasks are defined and controlled through a Work Breakdown Structure (WBS). Functional budgets are established for time-phased tasks within each WBS element. Technical requirements are built into detailed milestone schedules and are firmly established as the performance measurement baseline. Simple and timely tracking techniques are utilized to monitor program progress. Daily meetings are held in an Action Center where all work elements, functional budgets, milestone lists, and critical items affecting technical performance, schedule, and cost are reviewed and updated. Actual costs are posted weekly for monitoring cost trends and variances against budgets. Program performance is summarized monthly and reported in terms of a Performance Index. This management system also provides full visibility of program plans and progress at all levels. Indications of program problems usually surface in the early stages, thus making recovery possible. All information is readily available for customer review and is used as the basis for informal and formal program reporting. People manage but good systems help them manage better.

Program Planning in Industry, by Robert H. Carpenter, Rockwell International, Anaheim, California, *Optical Engineerin* 18:6, November/December 1979.

Have you ever been surprised at the results of a competitive procurement? The winner or winners, the losers, the mix of the teams, the contract value, etc.? This paper bears directly on these factors and also provides insight into why industry sometimes does and sometimes does not choose to invest its R&D and marketing resources in optics program opportunities. Program planning by industry has existed in a variety of forms for many years. The evidence of the effectiveness of this planning, i.e., successful companies, is too powerful to ignore. What changed the world around for industry planning was the budget crunch which has developed in recent years within DoD. The expression "Fixed Sum Game" used in industry is a way of life for DoD. This means prioritization, goal setting, contingency planning, defining and assessing risk, commitment of resources, "keeping it sold," etc. It also means cretionary resources at the "profit center" limited dislevel. The quality of program planning data, information, and intelligence must be at least adequate if there is to be effective planning in industry. If an opportunity and its relationship to other DoD programs is a well-kept secret, the resultant offers may be fairly disappointing when the time comes to evaluate the proposals received. Without reasonable dialogue with the DoD planners and the military service Program Managers in implementing those plans, industry is less likely to do an effective job, but with good and equitable planning information made available and communication lines kept open, industry can develop reasonable plans, identify their opportunities, their limitations, and define the factors involved which will allow them to relate a particular opportunity to their plans and receive management support. The payoff to DoD must certainly be greater efficiency on the part of their contractors, which should ultimately mean that the products and services of industry are available at a more attractive price.

Book Reviews

THE INFRARED HANDBOOK, William L. Wolfe and George J. Zissis, Eds. 1700+ pages, 1144 figures, 342 tables, 1134 references, 1582 bibliographic entries. Published by the Infrared Information and Analysis Center, Environmental Research Institute of Michigan, Ann Arbor (1978) $26.25.

Reviewed by R. Barry Johnson, Science Applications, Inc., 4060 Sorrento Valley Boulevard, San Diego, CA 92121.

The Infrared Handbook is the long-awaited replacement for the popular, but now rather obsolete, *Handbook of Military Infrared Technology* published in 1965. The new handbook contains twenty-five chapters comprising over 1700 pages (as compared to the 900+ pages in the old handbook), 1144 figures, 342 tables, 1134 references, and 1582 bibliographic entries. It is evident that much thought and care went into the preparation of this document when one examines the consistency of format, clarity of figures and tables, and the paper opacity. Considering that the new handbook contains almost 90% more pages than the earlier handbook, it is a credit to the editors, *et al.*, that they succeeded in avoiding the use of multiple volumes. The new handbook is about 2-5/8" thick compared to its predecessor's 2" thickness. Many of the twenty-two authors were also contributors to the first handbook and somewhat over half of the material was written by members of the editors' institutions, viz., ERIM and the University of Arizona.

Before commenting on the specific content of *The Infrared Handbook*, I would like to note that an excellent feature of this handbook is that each chapter begins with a statement of the symbols, nomenclature, and units used in that specific chapter. Since it is essentially impossible for a book of this magnitude to conform to an uniform set of symbols, units, and nomenclature, this feature should be of great value to users of this document.

The organization of *The Infrared Handbook* is logical and flows well. It is clear that an effort was made to correct some of the shortcomings of the earlier handbook. For example, the editors deleted certain of the topics contained in the old handbook (e.g., control systems and thermal design), expanded and updated the chapters on radiation theory, sources, atmospherics, optical materials, optics, and detectors, and replaced the inadequate chapter on system design in the first handbook with four quite good chapters on certain aspects of infrared system design. In addition, a much-needed chapter on displays was added as were chapters devoted to detector technologies basically not known in 1965.

The first chapter deals with the fundamentals of radiation theory; a significant portion of the chapter is devoted to calculational methods (a number of pocket calculator programs are given). Chapters 2 and 3 present material on artificial and natural sources. In these two chapters, analytical models, field and laboratory measurements, and selected manufacturers' data are given. The quantity of data is significantly greater than that contained in the *Handbook of Military Infrared Technology*, and the discussion of certain phenomenology not included in the earlier handbook is most welcome. The next three chapters cover the topics of atmospheric scattering, absorption, and turbulence at a level of some detail and provide guidance for those who require a more in-depth knowledge. Chapter 7 discusses the various optical materials useful in the infrared, optical filters, and data useful for working (grinding and polishing characteristics) various optical materials. The next two chapters are devoted to optical design and systems. The material contained in these chapters is basically the same as was in the old handbook; however, some expansion of certain topics is evident as is the inclusion of some new material, e.g., three-mirror systems and optical testing methods. Chapter 10 covers various types of optomechanical scanning methods and techniques. Although this chapter should be of service to many users, it is regrettable that more breadth and depth were not given. Had adequate references or a more complete bibliography been included in this chapter, the brevity of the chapter may well have been compensated; however, it should be noted that only three pages addressed this topic in the old handbook. The next four chapters deal with various detector technologies applicable to infrared systems. The first of these discusses "classical" thermal and photon detectors. Chapter 12 covers the topic of charge-coupled devices as related to infrared applications, an area that did not exist when the original handbook was published. The infrared CCD, which is still in a developmental phase, will markedly change the design and in some cases the use of infrared systems. This chapter is an excellent introduction to the rapidly advancing IRCCD field and guides one to additional sources of information. The subsequent chapter discusses imaging tubes wherein vidicons, both conventional and pyroelectric, are emphasized. Chapter 14 provides an overview and selected data on photographic film useful for infrared applications. A much expanded and updated discussion on cooling systems is contained in Chapter 15. In the next chapter, considerations associated with detector electronics are covered. The material is similar to that contained in the earlier handbook, but is updated and expanded (discussion on vacuum tubes was deleted). Chapter 17 discusses in some detail reticle systems (also covered in Chapter 22 from a somewhat different viewpoint), sampled data images, and discrimination. The following chapter provides a generally excellent discussion on display requirements and technologies; however, the human factors aspects are not covered in as much detail as one might desire. A variety of infrared imaging systems' specifications are included in Chapter 19 along with a rather good discussion on infrared system sensitivity analysis and design considerations. A point to note is that guidance is included to aid in the specification of thermal imaging systems. Radiometry is the theme of the next chapter. Topics include radiometers, spectroradiometers, interferometers, and other types of spectrographic instruments. Although this is an excellent chapter, I found it disappointing that the fundamentals of the radiometry of images and the like were not incorporated. Chapters 21, 22, and 23 cover the topics of warning, tracking, ranging, communications, and simulation systems. Both active and passive systems are discussed in some detail. The content of these chapters is a significant improvement over the prior handbook, is well balanced, and is presented in a manner that should be of value to users of *The Infrared Handbook*. Many readers will likely find the portion of Chapter 23 that addresses system simulation (both mathematical and hardware-in-the-loop) very interesting. Chapter 24 discusses aerodynamic influences on infrared system design and is essentially the same material which appeared in the first handbook. The final chapter provides a wealth of data pertaining to updated physical constants and conversion factors.

In general, *The Infrared Handbook* fulfills the objective of a handbook, i.e., a concise reference book and a guide to additional, more in-depth, material. However, I feel that it fails to provide adequate guidance to reference material in several chapters, most notably Chapter 10 (Optical-Mechanical Scanning Techniques and Devices). The numerous references to private communications are of marginal value to the handbook's users and the reference by one author to his personal files is worthless. Also, I find it regrettable that references to patents are not given since many patents contain excellent technical guidance for the infrared practitioner.

Without question, anyone who is involved in the area of infrared systems should have a copy of *The Infrared Handbook* on his or her bookshelf. Should any reader find an error in the handbook (there are a number of minor ones), please send a note to Dr. George Zissis at ERIM describing it. The intention of ERIM, according to Dr. Zissis, is to develop an errata sheet for the handbook and send it to all purchasers during the spring of 1980.

SIGNAL PROCESSING (a new journal), Murat Kunt, Editor. Quarterly, ISSN 0-165-1684. North Holland Publishing Co., P. O. Box 211, 1000 AE Amsterdam, The Netherlands. Df1 150 (about $75) per year.

Reviewed by H. J. Caulfield, Aerodyne Research, Inc., Bedford Research Park, Bedford, MA 01730.

This new publication is the official publication of the European Association for Signal Processing (ERUASIP). The hugh editorial board is entirely European. None is primarily an optics specialist. Unfortunately, from this reviewer's point of view, this is a commerecial enterprise of the North Holland Publishing Co. There is the consequent conjunction of no page fees and a high subscription price.

The content of the sample issue I saw was of great interest to me. Two papers were on image processing (despite the journal's title). Two were on digital signal processing methods. One was on linear prediction. All were very readable.

I noted some disturbing items--an article containing no test reference to its first reference article, several misspellings, etc.

In all, I think this will be a helpful journal for readers who want to do optical or hybrid signal or image processing or pattern recognition.

People

1980 officers of the American Association of Physicists in Medicine (AAPM) are President Robert G. Waggener, professor, dept. of radiology, division of medical physics, the University of Texas Health Science Center, San Antonio; **President-elect Colin G. Orton,** director of medical physics at Rhode Island Hospital, Providence; **Secretary Arnold Feldman,** radiological physicist at Methodist Medical Center of Illinois, Peoria; **Treasurer Ann Forsaith,** manager, medical physics section, dept. of medical physics and engineering, William Beaumont Hospital, Royal Oak, Michigan.

American Electronic Laboratories, Inc., has appointed **Stephen E. Lipsky** senior vice president, Government Operations Group. Previously he was director, Advanced Systems, ESD Div. of General Instrument. Also newly appointed is **Emmanuel Harhigh** as marketing manager, Service Division.

Richard E. Sherwin has joined the Electro-Optics division of **EG&G** in a newly created position of Field Sales Engineer, responsible for sales of light instruments, photodiodes, flashtubes, transformers, thyratons, krytrons, etc.

Hinds International, Inc., has appointed **Jimmie Moglia** manager of its Instrument Division. He will administer marketing and sales strategy for basic research, industrial and environmental control instrumentation. Previously he was with Tektronix, Inc., in international marketing.

Herbert A. Elion has been appointed Chief Executive Officer of **International Communications & Energy, Inc. (ICE).** He will be involved with R&D strategy, long-range planning, invention and investment decisions. In addition he will continue to serve with the Advisory Committee on Information Processing and Communications for the Executive Office of the President of the United States. Dr. Elion joins ICE after serving twelve years as Managing Director of Electro-Optics at Arthur D. Little, Inc. He holds patents in imaging systems, laser applications, optics, and instrumentation. He has written or edited 17 technical books and is author of approximately one hundred technical papers. Dr. Elion has been a keynote speaker and chairman at many international and specialized symposia, and invited lecturer with the Korean, Brazilian, French, Japanese, Canadian and U. S. governments.

Imperial Computer Services, Inc. (ICS) has appointed **John G. Deeney** head of East Coast operations of the Consulting Group. Deeney, a vice president of ICS, was formerly a partner in Booz, Allen and Hamilton. **Max P. Beere** has joined ICS as vice president of the Consulting Group. He was formerly director of telecommunications planning for TRW Electronics in Los Angeles.

ITT Cannon Electric has appointed **Terry McCarthy** manager/advertising. He was formerly western region manager of marketing communications for the Electronic Components Group of TRW. **Robert D. Malucci,** physicist, has been named manager of the applied research and contact physics department at ITT Cannon Electric.

Jerry Demsky has been appointed Standard Products Marketing Manager for **MIC-Maruman Integrated Circuits.** Demsky will market MIC's line of industry standard microprocessors, memories and microprocessor support circuits. Previously, Demsky was consumer marketing manager with American Micro Systems, Inc.

Optronics International announces the election of **John R. Gosnell** as Chairman of the Board, and **Rudolph Kadlec** as a Board Member. Kadlec is Executive Vice President, Chief Operating Officer and has been with Optronics for one year. **Colin Barton** has been appointed Vice President of Marketing/Product Planning; he served most recently as Market Development Manager for Graphic Computing Systems at Tektronix, Inc.

Peter M. Baker has been named President of **Quantrad Corp.** Baker, who has headed Quantrad's marketing program since 1977, replaces **Patrick Clarke** who resigned to pursue consulting assignments.

Times Fiber Communications, Inc. has made the following appointments: **Richard Green,** formerly with ABC, has been appointed Director of Engineering/Fiber Optics. He will be responsible for design