

# Book news

## 1. Book reviews

- *Rudiments of mining practice*, by C.E. Gregory. Clausthal-Zellerfeld (West Germany), Trans Tech Publications. US\$24.

**Reviewer: A.N. Brown**

Professor Gregory has had a wide experience of hard-rock metalliferous mining throughout the world, being a well-known academic who has taught at many universities in the Western World. His basic training was obtained in his native land of Australia. In this publication, he identified the need for a basic, simple book on mining practice to provide new students of mining with a background to their studies. He also designed the book to provide a background to persons operating on the fringes of the industry such as students of economics and journalists.

The text extends to only some 120 pages, and contains a sufficient number of monochrome sketches, diagrams, and photographs. It is written in a straight-forward, easy-to-read style. The book contains an index and elementary table of conversion from imperial to SI (metric) units, and there is also a glossary of mining terms that most readers would find useful.

The author has succeeded in keeping the contents simple, as indicated by the title. However, after each chapter, there are references to further recommended reading. The book could be useful in the South African context, although the coverage of coal and opencast mining operations is slender.

- *Secondary steelmaking for product improvement*. London, Institute of Metals, 1985. 256 pp. US\$35.

**Reviewer: R.J. Dippenaar**

These 29 papers represent the proceedings of an international conference sponsored and organized by the Iron-making and Steelmaking Committee of the Metals Society, London, in October 1984. The proceedings can conveniently be divided into four areas of concern for steelmaker and customer alike:

- Future product demands
- Process considerations
- Application of secondary steelmaking processes
- The latest plant designs.

The historical development of product specification, the current philosophy, and future demands for high-quality steel products were analysed, and the ability of the steel industry to adapt to market demands received attention. It seems that a new era has emerged where the relationship between steelmaker and customer has grown to such a level of maturity that realistic specifications can be drawn up, and that both parties appreciate the factors involved in the optimization of product costs. It was clearly shown that it is technically possible to achieve very low impurity contents in steel on a production scale ( $C+S+P+O+N+H < 70$  p.p.m.). However, the manufacture of these very high-quality steels incurs consider-

able expense for installation and labour, so that in every case the additional cost has to be weighed against improvements.

Secondary steelmaking processes as applied to various end-products were discussed in considerable detail. Plates, sections, strip, welded tubes, rods, low-alloy steel, and stainless steel received attention. Although it was shown that in some cases high-purity steel can be produced without the installation of extensive new facilities, it is normally necessary to employ vacuum-degassing techniques in order to attain the required purity. It was reported that a combination of the correct choice of equipment, a fundamental understanding of the processes involved, and computerization of the production operations contributed significantly to improved product quality in the manufacture of stainless steel.

New developments in equipment and plant design were reported, including improvements in tried processes like the RH and DH degassing systems. Also, the application of relatively new technologies to industrial steelmaking processes were demonstrated. Special emphasis was placed on ladle-stirring and injection techniques. The practical application of vacuum-arc degassing technology to the production of ingot, low-alloy, and stainless steels was elucidated.

The Conference clearly showed that certain procedures have become generally accepted in the world of steel-making. Bath stirring and bottom blowing of the BOF have become standard practice, and so has the use of large tundishes in continuous casting. Desulphurization and dephosphorization with synthetic slags, followed by calcium treatment, and the general use of vacuum degassing units for obtaining high-purity steel, have become accepted practices in the manufacture of quality steel.

The necessity for fundamental, as well as applied, research was stressed. It is imperative that the role of alloying elements and impurities in the final steel products should be fully understood. Also necessary is a full understanding of the scientific principles underlying metallurgical processes. It was suggested that emphasis should be placed on a better understanding of the kinetics of the chemical reactions involved in steelmaking processes, and that process-modelling techniques should be applied to 'tune' ladle processes to maximum efficiency.

- *Sampling and weighing of bulk solids*, by J.W. Merks. Clausthal-Zellerfeld (West Germany), Trans Tech Publications, 1986. US\$45.

**Reviewer: J. Waudby**

Sampling theory and practice are all too often poles apart: the theorist being preoccupied with esoteric mathematics, and the practical production man caring little for such considerations, often to the extent that the most junior member of his staff is entrusted with the important task of 'taking a sample'. It is difficult to wholeheartedly find fault with this approach since standard works on sampling theory tend to be deadly dry and liberally sprinkled with jargon, and to assume that the reader is fully conversant with advanced statistics. Mr Merks has made an effort to ensure that his book is both readable and intelligible. He introduces each chapter with a piquant quotation from Lewis Carroll, although one

wonders whether this is inspired more by the Looking Glass world of uncertainties facing the sampler than by the author's esteem for Mr Carroll's mathematics!

The inclusion of a comprehensive glossary of symbols and definitions, and of two chapters dealing with probability and applied statistics, makes the book a worthwhile acquisition in itself, and the chapters on sampling, sample preparation, analysis, and weighing are presented authoritatively and thoroughly, reflecting the author's wide experience in this field. The book is on the whole well illustrated, with clearly laid out examples.

A bonus is an appendix of statistics programs suitable for a Hewlett Packard HP 41C calculator; it is a pity that similar programs in BASIC are not included.

To summarize, Mr Merk's book, volume 4 in the Trans Tech Series on Bulk Materials Handling, should prove to be an indispensable reference work for anyone concerned with the mining, beneficiation, analysis, and shipping of bulk materials.

## 2. Recent publications

- *Canadian minerals yearbook 1985*. (Mineral Report 34). C\$ 44.35.

This issue is a report of developments in the industry during 1985. The chapters deal with specific commodities, a general review, a regional review, a list of selected mineral commodities, and a statistical summary.

- *Mine reserves and currently promising deposits—gold, silver, lead, zinc, copper, nickel, molybdenum—January 1985* (Mineral Bulletin MR 209), by A. Lemieux and W.H. Laughlin. C\$ 6.00.

This biennial publication presents tonnages and grades of mine reserves compiled on a consistent basis from year to year. It also contains tonnages and grades for additional deposits that appear most promising for future production.

Copies of the above two publications are obtainable from Printing and Publishing, Supply and Services Canada, Hall, Quebec K1A 0S9, Canada.

- *Advances in uranium ore processing and recovery from non-conventional resources*. Vienna, International Atomic Energy Agency, 1985. 335 pp. 640 Austrian schillings.

This volume contains the proceedings of a technical committee meeting that was organized by the IAEA and held in Vienna in September 1983. It consists of a review paper on the processing of uranium ore, 9 papers on the recovery of uranium from ore, 4 papers on its recovery from phosphoric acid, 4 on its recovery from coal and natural waters, and 3 panel reports. Four of the papers are in French.

- *So rich an inheritance*, by James Ambrose Brown. Johannesburg, Prototypal Publications, undated. 152 pp.

This book covers one hundred years of mining on the Witwatersrand, having been written to commemorate Johannesburg's centenary. The emphasis is on the people who built up the city, as the section headings indicate: The Seekers and the Search, Miners and Methods, The Nation Builders, and Towards the Future.

- *Financial Times mining international year book 1986*. Harlow (England), Longman Group, 1985. 578 pp. £52.

The *Mining Year Book*, now in its 99th year of publication, is a standard work of reference on the mining industry. The greater part of the book provides narrative, production, and financial details on the major companies involved in the mining and processing of metals and minerals throughout the world. A section on leading mining and metals associations and institutes is also included.

- *Annual Report 1985*. Greenford (England), International Tin Research Institute, 1986.

The 1985 Annual Report contains full details of the technological research-and-development projects that have been undertaken to increase the use of tin, and the signing of the new I.T.R.I. constitution by governments of the tin-producing countries.

- *Register of Australian mining 85/86*. Perth, Resource Information Unit (P.O. Box 7347, Cloisters Square, Perth, 6001 Australia), 1986. \$A170 (air mail).

This is a comprehensive annual on all significant oil-gas and mineral deposits, operating or under advanced exploration, in Australia, and it is widely used both in Australia and overseas as an up-to-date and complete compendium.

The 1985-86 edition contains at least 3200 entries for oil and gas deposits, mineral deposits, public and private resource companies, and relevant government and private institutions. This year a separate new section was introduced for platinum because of the mounting activity and intriguing results emerging for this precious-metal family. There is also an expanded section on rare earths.

- *Mines and mining equipment and service companies worldwide 1986-87*, by D. Nelson. London, E. & F.N. Spon, 1986. 660 pp. £48.50.

The main reference section of the book presents mines and mining equipment and service companies in alphabetical order. The products and services that these companies supply are classified in the equipment, services, and products guide so that, say, the manufacturers of weighing equipment or the principal gold-mining companies can readily be located. The geographical index lists companies by the location of their headquarters. The company index is divided into two parts, the first covering mining companies, and the second covering equipment manufacturers, consultants, and service companies. The handbook covers all aspects of the mining industry worldwide, including the principal operating and financial mining companies and the equipment, service, and consultancy companies. This third edition includes many more companies, and more data are provided in the individual entries.

## 3. Mintek reports

The following reports are available free of charge from the Council for Mineral Technology, Private Bag X3015, Randburg, 2125 South Africa.

### ● Report M126D

*The efficiency of heavy medium separation at the Buffalo Fluorspar Mine.* 1st issued Apr. 1984; reissued Mar. 1986.

Laboratory tests were undertaken in attempts to evaluate the performance of the heavy-medium separation (HMS) plant at the Buffalo Fluorspar Mine, and to determine the reasons for variation in the efficiency of separation. However, changes in plant procedure and equipment since the start of the testwork have probably made this aspect of the investigation superfluous.

The various ores submitted were first evaluated in washability tests, and the results were then used in a determination of the optimum conditions for concentration by HMS to yield concentrates assaying about 60 per cent  $\text{CaF}_2$ .

HMS tests were then conducted in a heavy-medium cyclone separator of 150 mm diameter to confirm the results of the washability tests. The effects on separation efficiency of changes in the grade and feed density (separating density) of the medium were studied, and the optimum conditions for the separating medium were established.

Finally, HMS tests were conducted to confirm the optimum operating conditions determined for each ore in the production of the required concentrate grade of 60 per cent  $\text{CaF}_2$ .

It is noted that the ores mined vary considerably in their response to concentration by HMS, that a medium of grade 150D will be suitable as the separating medium, and that density differentials of between 0,2 and 0,4 density unit will give the required efficiency of separation.

The following facts must be considered in the evaluation of the laboratory results and their application to the mine plant. The laboratory tests were done on individual ores and on sized feeds, whereas it is the practice at the mine to treat a feed of mixed particle size (recently adopted) and to feed mixed ores of varying washability (selective mining not always being feasible).

### ● Report M143D

*The recovery of chromite fines from tailings dumps.* 1st issued Apr. 1984; reissued Mar. 1986.

The possible retreatment of chromite tailings dumps for the production of concentrates containing less than 1,0 per cent  $\text{SiO}_2$  and more than 45 per cent  $\text{Cr}_2\text{O}_3$  was investigated.

Preliminary tabling tests of boreholes samples showed that the material was amenable to gravity concentration for the production of the required grades, but that the recovery of  $\text{Cr}_2\text{O}_3$  would be low.

Conventional spiral concentration did not produce the required grades at  $\text{Cr}_2\text{O}_3$  recoveries of more than 50 per cent, and it was concluded that such grades could be achieved only at the expense of recovery.

The use of elutriation as a supplementary stage in the spiral-concentration procedure enabled concentrates of 45,9 per cent  $\text{Cr}_2\text{O}_3$  and 0,89 per cent  $\text{SiO}_2$  to be produced. The recovery of  $\text{Cr}_2\text{O}_3$  amounted to about 55 per cent of that present in the feed. A flowsheet depicting the essential features of such a retreatment procedure is given.

A larger version of the laboratory elutriator, suitable

for incorporation in a plant circuit, was built and tested for the recovery of chromite from tailings dumps. Initial tests at the Council for Mineral Technology (Mintek) showed this elutriator to have a capacity of 4,5 t/h. Tests at a mine plant using a bank of eight spiral concentrators to provide the feed to the elutriator gave the following results: 46,2 per cent  $\text{Cr}_2\text{O}_3$  and 1,01 per cent  $\text{SiO}_2$  as concentrate grades, and a recovery of 31,3% of  $\text{Cr}_2\text{O}_3$ .

The feedrate to the elutriator for this result was 2,7 t/h. This feedrate could not be increased owing to difficulties with the feeding system.

Tabling was tested as an alternative to spiral concentration and, when used in conjunction with an elutriator, gave substantially higher recoveries at similar concentrate grades than did spiral concentration. The use of tables is not, however, practical for large-tonnage operations.

It is recommended that, if elutriation is incorporated into a gravity circuit for the recovery of chromite from tailings dumps, no attempts should be made to increase the size of the elutriator, but that more than one unit of smaller size should be used.

A mineralogical report, which identifies gangue materials not rejected by normal gravity means, and a description of the operation of the pilot-plant elutriator are included as appendices.

### ● Report M245

*Standard test methods for the strong-base resins used in the recovery of uranium.*

There are no detailed specifications for the strong-base ion-exchange resins used in continuous ion-exchange plants, and it was considered that a very useful purpose would be served by the publication of a series of standard laboratory tests on which such specifications could be based.

This report describes test methods that are relevant to the ion-exchange recovery of uranium. They include tests of the physical properties of strong-base resins (relative density, particle-size distribution, and moisture content) and of their chemical properties (theoretical capacity, equilibrium capacity, kinetics of loading and elution). Included are several supporting procedures that are used in conjunction with these methods.

### ● Report M254

*The development and evaluation of an instrument for the measurement of resin concentration in pulp.*

The development and evaluation of a new instrument for the measurement of resin concentration in pulp is presented. Two prototype resin-concentration meters are described, which operate by measurement of the attenuation of ultrasound at two different frequencies in resin and pulp suspensions.

The attenuation of ultrasound at the lower frequency was found to be relatively insensitive to changes in the concentration of resin. This is a consequence of the relatively long wavelength of ultrasound in the pulp compared to the size of the resin beads. The attenuation at the higher frequency was observed to be a function of the pulp density and of the resin concentration, the wavelength at this higher frequency being close to the dimensions of the resin beads. Both the resin concentra-

tion and the pulp density can be calculated from the measurements of attenuation at two frequencies.

The final prototype instrument was designed to operate in pulps of densities between 1,45 and 1,60 g/cm<sup>3</sup> with resin concentrations between 0 and 10 per cent by volume. The root-mean-square error in the measurement of resin concentration was found to be within 0,5 per cent of the actual resin concentration with a worst-case error of 1,3 per cent. Using the measurement of attenuation at 321 kHz it was found possible to measure the pulp density to an accuracy of 0,02 g/cm<sup>3</sup>.

● **Report M255**

*The preparation and certification of a low-silicon ferro-silicon metal powder for use as a reference material.*

This report describes the preparation, analysis, and certification of South African Reference Material (SARM) 33.

The material is a milled ferrosilicon metal powder with a silicon content of approximately 15 per cent. It was produced by Samancor, and is used in heavy-medium separation. Twenty laboratories in seven countries provided analytical data for 18 elements, nine of which were assigned certified values.

● **Report M258**

*A market survey and alloy classification of hardfacing materials available in South Africa.*

The nature of abrasive and impactive wear is discussed briefly, after which a description is given of various processes used for the laying down of hardfacings on metals. The advantages and disadvantages of the different processes are discussed.

The main part of the report consists of a classification of the consumables used in hardfacing processes. In the classification, the hardness of the deposit is considered

as a function of total alloy content. This classification shows that the consumables can conveniently be divided into eight groups: five into the so-called alloy type and three into the hardfacing type, which consists of particles of the primary carbide phase dispersed in an iron-rich matrix.

A brief metallurgical description is given for each group, together with typical areas of application.

● **Report M262**

*The presentation of measurements on simplex test pipes during service.*

The collecting of data is a basic requirement for any investigation, but the clear presentation of the data is equally important. The use of various graphical techniques can help convey an understanding of the processes that are involved in an investigation.

This report describes various running-time records, measurements of wall thicknesses and rates of wear, and contour plots that were made during an investigation into abrasive wear in a pipeline conveying concentrate slurry at a diamond mine.

● **Report M283**

*A revised ion-chromatographic method for the determination of free cyanide*, by C. Pohlandt-Watson. Oct. 1986. 9 pp.

The ion-chromatographic procedure for the determination of 'free' cyanide has been revised to exclude the cyanide contributed by the partial decomposition of some of the metal cyanide complexes. The resulting method gives a more accurate account of free cyanide present in waters, effluents, and process solutions. The precision (relative standard deviation) is 0,0289 at concentrations of 100 µg l<sup>-1</sup> in simulated tap water.

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## Mining and the environment

The Australasian Institute of Mining and Metallurgy and The Institution of Engineers, Australia, have decided to conduct an Australasian Conference on the theme of 'Mining and Environment—a Professional Approach'. The papers will be at a professional level, but attendance will be open to everybody with an interest in the subject. The Conference will be held in Brisbane on 20th and 21st July, 1987.

The eight quarter-day sessions will all be plenary, i.e. there will be no concurrent specialist sessions. The programme will be arranged broadly as follows:

- Session 1—Opening Address
- Sessions 2 to 7 inclusive—Papers on environmental

considerations of mining (including ecological, social, planning, and legal aspects) with regard to:

- Session 2—Exploration
- Session 3—Project development
- Session 4—Social aspects
- Session 5—Operations
- Session 6—Rehabilitation
- Session 7—Pollution control.
- Session 8—Integration/Summing-up.

Interested authors are invited to submit the titles of proposed papers, together with a synopsis of about 250 words, outlining the aims, contents, and conclusions of their papers. Synopses should be accompanied by a statement of the author's intention to attend.

## New President of AS&TS

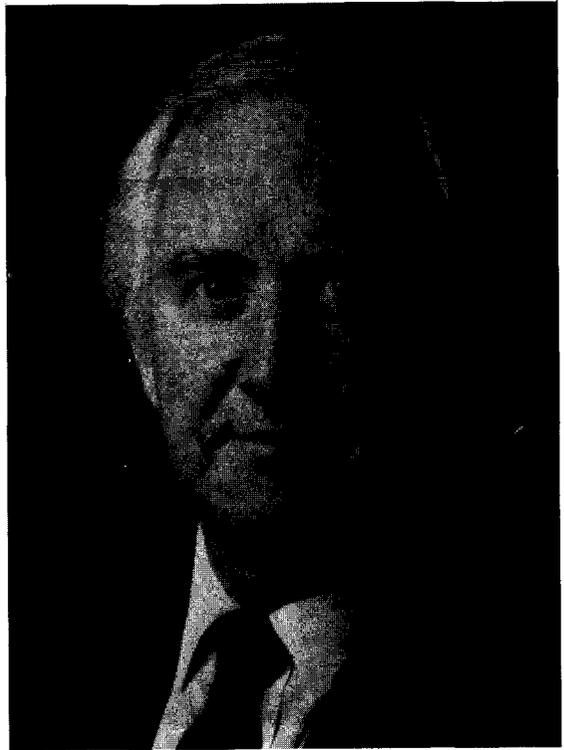
Dr Philip John Donne Lloyd took office as President of the Associated Scientific and Technical Societies of South Africa on 26th November, 1986. He was educated at Bishops and the University of Cape Town, and obtained a B.Sc. (Chem. Eng.) in 1958 and a Ph.D. in 1961. His Ph.D. thesis, on the solvent extraction of uranium, laid the foundation of the Purlex process, which was eventually adopted on most uranium plants.

Dr Lloyd joined the Atomic Energy Board in 1961, and took up an International Atomic Energy Agency fellowship in 1962. He spent nearly three years at the School for Advanced Studies, Massachusetts Institute of Technology, where he studied nuclear engineering and conducted research on isotope separation and fuel reprocessing. He returned to the Atomic Energy Board in 1965, and worked at the National Institute for Metallurgy (now Mintek) as a Senior Research Officer, where he was primarily concerned with the extension of his doctoral thesis on the solvent extraction of uranium. This work led to the introduction of the Bufflex and Purlex processes, the latter being the most widely employed method for the recovery of uranium in South Africa today. He also worked on uranium purification to nuclear-grade specifications and the production of  $UO_2$  and  $HF_6$ .

In 1967 he joined the Chamber of Mines Research Organization as Director of Metallurgy, where he initiated studies of a portable gold analyser and centrifugal mills in 1969, which led to new sampling techniques in gold mines, and a possible radical change in gold-mining technology by underground concentration and back-filling.

Since 1983, Dr Lloyd has been employed by Engineering Management Services as Managing Director of EMS Minerals. He is an internationally recognized expert in extractive metallurgy, with additional experience in mine valuation, mine filling, materials handling, radiation protection, and environmental control.

Dr Lloyd has served on the councils of the S.A. Chemical Institute and the S.A. Institution of Chemical Engineers. He was President of the latter body from 1977 to 1979, and then President of the Federation of Societies of Professional Engineers for two years. He is a Fellow and gold medallist of The S.A. Institute of Mining and Metallurgy and is a member of the American Institute of Mining, Metallurgical and Petroleum Engineers. He

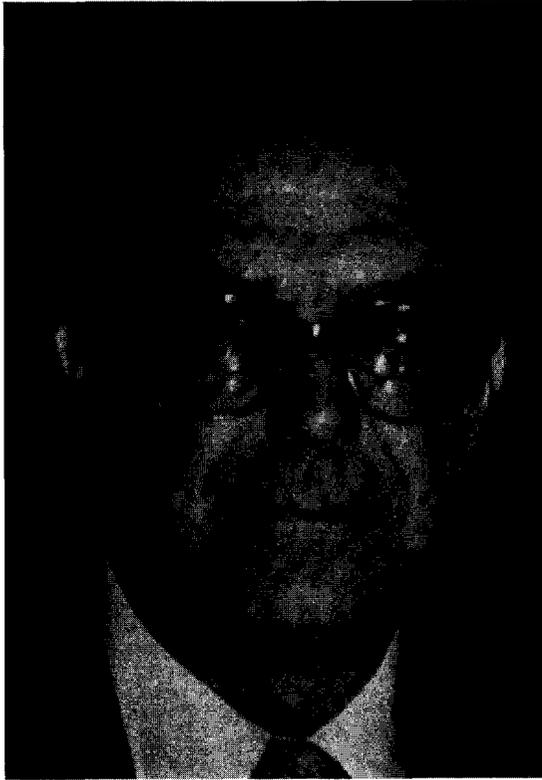


**Dr P.J.D. Lloyd, President of AS&TS**

was Treasurer of the Associated Scientific and Technical Societies of South Africa from 1979 to 1984, and served as a Vice-President of that body in 1985 and 1986.

Dr Lloyd represented South Africa at the Commonwealth Engineers Council in London and the World Federation of Engineering Organisations in Warsaw, in 1977. He is a professional engineer, and serves on the executive of the S.A. Council for Professional Engineers, the statutory body that controls the profession in South Africa. He has made over 140 contributions to the scientific and technical literature.

Dr Lloyd was named one of four Outstanding Young South Africans by Jaycees in 1975. He was born on 9th September, 1936, and is a South African citizen.



## Another award for Prof. Krige

Professor D.G. (Danie) Krige, of the Mining Engineering Department of the University of the Witwatersrand and a long-standing member of The South African Institute of Mining and Metallurgy, has been selected as the 1987 recipient of the coveted Daniel C. Jackling Award. This Award is made annually by the Mining and Exploration (M&E) Division of the Society of Mining Engineers.

Professor Krige will present a lecture to accompany the honour at the Annual Meeting of the Division, which is to be held in Denver, Colorado, from 24th to 27th February, 1987. The Award itself will be presented to him at the M&E Division luncheon on 26th February, 1987.

Professor D.G. Krige, winner of the Daniel C. Jackling Award

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## New journal

*Dynamics and Stability of Systems* is a quarterly international journal designed to serve as an outlet for original research work concerning the stability, instability, bifurcation, and oscillatory behaviour of natural and man-made systems. It is a multidisciplinary journal, providing a common platform for cross-fertilization and catalysis of original ideas, theories, and methodologies:

Papers are now invited. The highest priority will be given to contributions of a general nature that are likely to have a permanent value. Papers delineating phenomena, or presenting new theories or analytical methods applicable to a broad class of systems, are in this category. Both linear and non-linear developments may be presented. Clarity of presentation, relevance, and applicability—to engineering or other scientific disciplines—will be distinguishing features in acceptable papers. Fundamental mathematical theories should conform to these qualifications to be appropriate for this journal.

High-quality research papers in all fields of applica-

tion that are based on valid mathematical models will also be considered for publication. Applications that illustrate new techniques and theories or involve recent developments in interdisciplinary areas are particularly welcome. Contributions concerning catastrophe theory and chaotic behaviour of systems are also welcome. Fields of application may range from various engineering disciplines to biology; including all areas of mechanics, electrical networks and control systems, chemical and biochemical systems, ecological systems, and many areas in physics and other disciplines.

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