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APPLIED SCIENCES

PERFORMANCE OF HYBRID TEA CO₂ LASER STUDIED

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 6, Jun 86
pp 501-505

[Article by Xu Hualuo [1776 5478 2867], Yi Jingrong [0122 2529 2837], and Cai Yingshi [5591 5391 2514] of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] Abstract: The operating characteristics of a hybrid TEA CO₂ laser are analyzed based on a numerical model. We have found the possibility of single longitudinal mode oscillation in a low-pressure CW CO₂ tube operating below the lasing threshold. The results have been borne out by experiments.

I. Introduction

A number of techniques have been developed to operate a TEA CO₂ laser in the single longitudinal mode.¹ Examples are: 1) Adding a F-P etalon in the cavity, 2) adding a gas absorption cell in the cavity, 3) using an injection locking device, and 4) hybrid gain medium consisting of a high pressure region and low pressure region. The distinct advantages of the hybrid devices are that they are easy to tune and that their single longitudinal mode operation is stable. They can therefore be combined with an external electro-optic trigger to form a pulsed CO₂ laser generator.

Theoretical studies of the operating characteristics of a hybrid CO₂ laser have been reported.²⁻³ Following the ideas advanced in Reference 3, we have introduced the role of a CW CO₂ tube and, starting from a numerical model, studied the operating characteristics of a hybrid TEA CO₂ laser under various conditions. Good agreements have been obtained between computed results and experimental test results.

The CW CO₂ tube serves two purposes: gain and intensity. When the small signal gain of the CW CO₂ tube is smaller than the threshold gain, the tube only provides amplification. When the small gain is greater than the threshold, the tube provides both gain and intensity.

II. Numerical Model

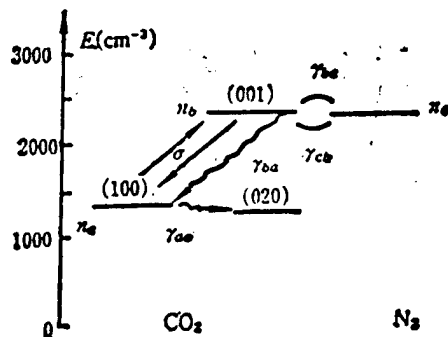


Figure 1. Energy-Level Diagram of CO₂ Transitions

Based on the four-level model of Gilbert shown in Figure 1, the multi-longitudinal mode rate equations of a CO₂ laser are:

$$\frac{dn_a}{dt} = (n_b - n_a)c \sum \sigma(\nu) q(\nu) + \gamma_{ba} n_b - \gamma_{a0} n_a - W_a, \quad (1)$$

$$\frac{dn_b}{dt} = -(n_b - n_a)c \sum \sigma(\nu) q(\nu) - \gamma_{ba} n_b + \gamma_{ab} n_a - \gamma_{b0} n_b + W_b, \quad (2)$$

$$\frac{dn_0}{dt} = -\gamma_{a0} n_a + \gamma_{b0} n_b + W_0, \quad (3)$$

$$\begin{aligned} \frac{dq(\nu)}{dt} = & (n_b - n_a) \frac{l}{L} c \sigma(\nu) q(\nu) - \frac{q(\nu)}{t_0} + W_s(\nu) \\ & + q(\nu) k(\nu) \exp\left[-\int I dt / E_s\right], \end{aligned} \quad (4)$$

where n_a , n_b , and n_c are respectively the particle densities of the lower energy level of the CO₂ laser, the upper energy level of the CO₂ laser and the first excited vibrational state of the nitrogen molecule, $q(\nu)$ is the photon density of the longitudinal mode at frequency ν , l is the length of the activated medium, L is the cavity length, γ is the collision transition probability, $W_s(\nu)$ is the photon density radiated to each longitudinal mode in unit time via spontaneous emission, t_c is the photon lifetime, defined by:

$$t_0 = \frac{2L}{c \ln(1/RT)}, \quad (5)$$

in which c is the speed of light, R is the reflectivity of the output mirror, and T is the transmissivity of the cavity. W_a , W_b , and W_c in (1), (2), and (3) are respectively the pumping rate for energy levels a , b , and c .

$$W_a - W_b = 0.4 W_0 = W_0 t \exp(-t/t_0), \quad (6)$$

Here t_0 is the width of the pumping pulse, W_0 is determined by the small signal gain of the TEA device. $\sigma(\nu)$ in (1)-(3) is the stimulated radiation

cross-section of the high pressure amplification tube and its relationship to frequency is given by

$$\sigma(\nu) = \sigma_0 \frac{(\Delta\nu/2)^2}{(\nu - \nu_0)^2 + (\Delta\nu/2)^2}, \quad (7)$$

where $\Delta\nu$ is the full width at half maximum of the gain curve.

Since the factor $k(\nu) \exp\left[-\int I dt/E_s\right]$ in the last term on the right-hand side of (4) is of importance, we shall describe its origin in detail. Similar to the TEA portion, the particle density variation of the upper and lower energy levels of the CW CO₂ tube may be described by:

$$\frac{dn'_a}{dt} = (n'_b - n'_a) \sigma \sum \sigma'(\nu) q(\nu) + \gamma'_{ba} n'_b - \gamma'_{ab} n'_a + W'_a, \quad (1')$$

$$\frac{dn'_b}{dt} = -(n'_b - n'_a) \sigma \sum \sigma'(\nu) q(\nu) - \gamma'_{ba} n'_b + \gamma'_{ab} n'_a + \nu'_{ba} n'_b + W'_b, \quad (2')$$

Primed quantities in (1') and (2') represent quantities of the CW CO₂ laser tube, carrying similar definitions as their counterparts in (1) and (2). In fact, the operating process of the entire TEA CO₂ laser is the back-and-forth propagation process of the pulse generated in the TEA portion in the low pressure tube. The typical width of an output pulse from the TEA CO₂ laser is about 100 ns, far less than that of various relaxation process in the CW CO₂ gain medium. Also, in the 100 ns interval, the excitation of the particle number may be ignored. Furthermore, since the gain linewidth of the CW CO₂ medium is very narrow (about 75 MHz), usually only one longitudinal mode falls within the linewidth. Hence, (1') and (2') may be simplified to:

$$\frac{dn'_a}{dt} = (n'_b - n'_a) \sigma \sigma' q, \quad (8)$$

$$\frac{dn'_b}{dt} = -(n'_b - n'_a) \sigma \sigma' q, \quad (9)$$

From (8) and (9), we have

$$\begin{aligned} \frac{d\delta}{dt} &= 2\delta \sigma \sigma' q, \\ \delta &\equiv n'_b - n'_a, \end{aligned} \quad (10)$$

Integrating (10) and making use of the relationships $I = ch\nu q$ and $\sigma = h\nu/2\sigma'$, we have

$$\delta = \delta_0 \exp\left[-\int_{-\infty}^t I dt/E_s\right], \quad (11)$$

where E_s is the saturation energy. From (11), we obtain the gain of the continuous tube:

$$k' = \sigma(\nu) \delta = \sigma'(\nu) \delta_0 \exp\left[-\int_{-\infty}^t I dt/E_s\right] = k(\nu) \exp\left[-\int_{-\infty}^t I dt/E_s\right], \quad (12)$$

where $k(\nu)$ is the small gain of the CW CO_2 tube. The frequency dependence of $k(\nu)$ is given by

$$k(\nu) = k_0 \frac{(\Delta\nu_{\text{CW}}/2)^2}{(\nu - \nu_0)^2 + (\Delta\nu_{\text{CW}}/2)^2}, \quad (13)$$

where k_0 is the small signal gain of the central longitudinal mode, and $\Delta\nu_{\text{CW}}$ is the full width at half maximum of the gain curve of the continuous tube. When k_0 is greater than the threshold gain, k_0 itself becomes the threshold gain because a continuous tube in the steady state can only operate at the threshold. The initial condition of $q(\nu)$ is determined by the light intensity already existing in the cavity. It should be mentioned that the actual gain curve of the continuous tube should have a Voigt lineshape but the error in using (13) as a substitute is very small. To explain the operation of the continuous tube, the author of Reference 2 added an extra constant excitation term on the right-hand sides of (1), (2), and (3). This approach is less than satisfactory for the following two reasons: 1) In an actual hybrid device the continuous tube is already in a stable state when the TEA part is discharge excited. The treatment of Reference 2 amounts to a simultaneous excitation of the TEA and the continuous tube, thus degrading the gain of the continuous tube, 2) this treatment ignores the saturation effect of the continuous tube. In our model the above two difficulties do not arise.

III. Results

Using the following parameters, calculations are performed on a Burroughs computer using the Runge-Kutta method:

l	L	V_{∞}	B	T
0.5m	2.23m	70cm ³	0.36	0.85
V_{∞}				
$P_{\infty}^{(CW)}$	$P_{N_2}^{(CW)}$	$P_{He}^{(CW)}$	$\Delta\nu_{\text{CW}}$	E_s
2 τ	1 τ	8 τ	74MHz	1.61mJ/cm ²
P_{∞}	P_{N_2}	P_{He}	$\Delta\nu$	σ_0
120 τ	60 τ	480 τ	3.8GHz	5.8×10^{-20} cm ²
γ_{ba}	γ_{cb}	γ_{bc}	γ_{∞}	W_0
0.0868 μs^{-1}	2.1 μs^{-1}	1.145 μs^{-1}	24.4 μs^{-1}	5.7×10^{18} cm ⁻³ μs^{-2}

Our calculation takes into account the effects of TEA population inversion of 50 longitudinal modes and the contribution due to the saturation of the continuous tube. We also assume that the center frequencies of the high pressure gain curve and the low pressure gain curve coincide.

The results in Figures 2 and 3 are obtained under the condition that the deviation frequency Δf is equal to zero for the longitudinal mode frequency ν_c and the center frequency ν_o of the gain curve. Curves (a), (b), and (c) in Figure 2 correspond respectively to the computed pulse waveform when the continuous tube is not operating, operating below the threshold, and operating above the threshold. These results are in good agreement with those in Reference 6. The experimental results of Reference 2 are also plotted here. The discrepancies in the pulse width are due to different cavity lifetime. In our calculation the output mirror reflectivity is 36 percent, whereas in the experiments of Reference 2, the reflectivity is 65 percent. Differences in the tail of the pulse are caused by different gas composition. In their experiment they used a high nitrogen content and hence had a greater intensity in the tail portion. Figure 2 shows that, under the three operating conditions of the continuous tube, the relative positions of the computer waveform agree fairly well with the relative positions of the experimental waveform. As we pointed out earlier, the theoretical treatment in Reference 2 assumed a simultaneous excitation of TEA and the continuous tube. As a result, the gain of the continuous tube was degraded and there was a considerable difference between the relative positions of the computer waveform and those of the experimental waveform.

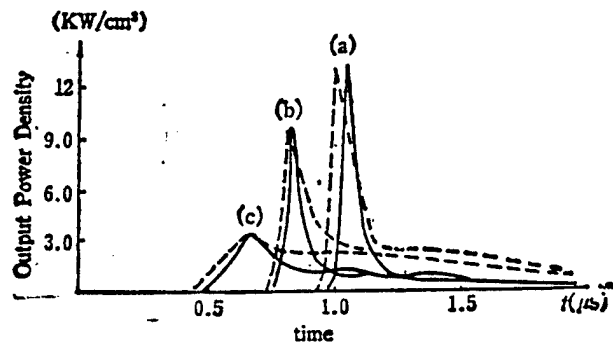


Figure 2. Calculated Output Pulse Shapes (The Broken Curves Represent Experimental Results of Reference [2])

(a) Low-pressure section not operating; (b) Low-pressure section operating below threshold; (c) Low-pressure section operating above threshold

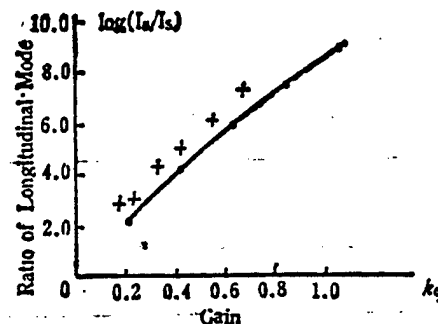


Figure 3. Dependence of the Ratio of I_c to I_s on the Gain of a Low-Pressure Section

I_c --density of center longitudinal mode; I_s --sum of the densities of other longitudinal modes k_0 represents threshold gain, crosses represent experimental results of Reference [7]

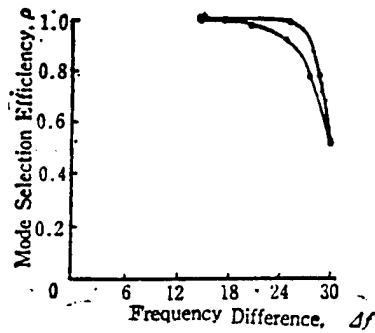


Figure 4. Relationship Between Mode Selection Efficiency and Frequency Difference, Δf is the Frequency Difference Between the Center of Gain Profile and the Closest Longitudinal Mode of the Resonator

Figure 3 shows the effect of the low pressure gain on the ratio of the central longitudinal mode intensity to the intensity of all the other longitudinal modes combined ($I_0/\sum I_i, i \neq 0$). The results in Figure 3 are basically in agreement with the experimental results in Reference 7 (also plotted here). In our calculation the pressure in the continuous tube is 11 Torr, whereas in Reference 7 it is 2 Torr. That is, our $\Delta \nu_{CW}$ is greater than that in Reference 7. Considering this difference, the agreement between theory and experiment is quite good.

Figure 4 shows the relationship between the mode selection efficiency and Δf . The mode selection efficiency ρ is defined as

$$\rho = \frac{I_0}{I_0 + \sum_{i=1}^{\infty} I_i} \quad (14)$$

where I_0 is the longitudinal mode intensity at frequency ν_c and Δf is the difference between ν_c and the center frequency of the gain curve. The calculated results show that the hybrid TEA CO_2 laser still operated in a single longitudinal mode even when the gain of the low pressure continuous tube is only 80 percent of the threshold gain and Δf is as high as 24 MHz. For a low pressure tube gain of 40 percent the threshold gain and a Δf of 18 MHz, the device operates in a single longitudinal mode. In the calculation the cavity length is 2.23 m and the corresponding longitudinal mode interval is 67.3 MHz. For a hybrid TEA CO_2 laser without a stable cavity length, we define a probability for a single longitudinal mode operation:

$$\mathcal{P} = 2 \frac{\text{Maximum } \Delta f \text{ for single longitudinal mode operation}}{\text{Longitudinal mode interval of cavity}}$$

Then, for the above two cases the probabilities are respectively 71 percent and 54 percent.

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CSO: 4008/86

Applied Mathematics

ON A CLASS OF METHOD FOR SOLVING PROBLEMS WITH RANDOM BOUNDARY NOTCHES AND/OR CRACKS-(IV) COMPUTATIONS FOR DEEP BOUNDARY NOTCHES AND/OR CRACKS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 1, Jan 86 pp 7-16

[English abstract of article by Ou Yangchang [2962 7122 7598], and Zhu Han [2612 3211] of Department of Applied Mechanics, Fudan University, Shanghai]

[Text] This paper continues the discussions to a class method for solving problems with random boundary notches and/or cracks in references by C. Ouyang in [1] (see also [2] and [3]). Using the basic method given in this reference as well as some further developments, we develop here a new effective computational method for solving random deep boundary notches and/or cracks. The actual numerical computations given in this paper show that the present method is quite workable and the results obtained have enlarged the contents of "Handbook of Stress Intensity Factors" given by G. C. Sih. (Paper received 26 Sep 84.)

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THE COMPUTATION OF NONLINEAR INSTABILITY FOR MULTILAYER COMPOSITE CYLINDRICAL SHELLS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 1, Jan 86 pp 17-23

[English abstract of article by Zhou Chengti [0719 2110 0232] of Dalian University, Dalian, and Zhou Jianping [0719 1696 1627] of Chansha Institute of Technology, Changsha]

[Text] In this paper, energy method and finite difference method are used to compute the instability behavior of multilayered fiber reinforced composite cylindrical shells under axial compression, hydrostatic pressure and torsion. The influences of initial imperfections, geometrical nonlinearities of shells and physical nonlinearities of the materials to the buckling and postbuckling behavior of the shells are considered. The effect of transverse shear is also discussed. The computational results of this paper are well agreed with the experimental data. (Paper received 11 Sep 84.)

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AN ESTIMATION METHOD OF BEARING STRENGTH OF BOLTED JOINTS IN FIBRE REINFORCED COMPOSITE

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 1, Jan 86 pp 95-101

[English abstract of article by Yang Jin [5017 1180] of Department of Aircraft Engineering Northwestern Polytechnical University, Xi'an]

[Text] Some researchers have estimated the strength of bolted joints in fibre reinforced composite, using simple and efficient engineering procedures. However, for these procedures the effect of clamping due to the strength of bolted joints is not considered. In this paper, a method is presented for predicating critical bearing strength of single-hole bolted joints in composite on the basis of observing and analysing the results of experiments. The clamping effect of bolts is considered. The calculated results correspond to the test data on Glaphic/Epoxy laminates. (Paper received 3 May 83.)

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CSO: 4009/1003

THE RESPONSE ANALYSIS OF SEVERAL NONLINEAR ISOLATION SYSTEMS SUBJECTED TO RANDOM EXCITATION

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 2, Feb 86 pp 109-114

[English abstract of article by Zhuang Biao Zhong [8369 5903 0022], et al. of Zhejiang University, Hangzhou]

[Text] The nonlinear isolation system is popular in modern isolation mounting. By using Fokker-Planck equation and the statistical linearization method and under the condition of random excitation, we discuss in this article the best damping selection of the dashpots of the stiffening nonlinear stiffness, the response characteristics of the single-degree-of-freedom isolation system of non-antisymmetrical and nonlinear stiffness, and the response analysis of two-degree-of-freedom nonlinear isolation systems. The selection of some parameters of the nonlinear isolation system is also dealt with by virtue of calculation examples. (Paper received 24 Mar 84.)

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FIXED POINT THEOREMS FOR FUZZY MAPPING (II)

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 2, Feb 86 pp 133-138

[English abstract of article by Zhang Shisheng [1728 4258 3932] of Department of Mathematics, Sichuan University, Chengdu]

[Text] Some new fixed point theorems for fuzzy mappings are presented. The results given in this paper improve and extend some recent results of [1, 4, 5]. (Paper received 7 Dec 84.)

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REPRESENTING GENERAL SOLUTION OF EQUATIONS IN THEORY OF ELASTICITY BY HARMONIC FUNCTIONS

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 2, Feb 86 pp 155-160

[English abstract of article by Nie Yiyong [5119 5030 0516] of Shenyang Institute of Computing Technology, Academia Sinica, Shenyang]

[Text] The general solution of the equations in the theory of elasticity is represented by seven harmonic functions, where there are only three harmonic functions independent of each other and every one of them has certain mechanics meaning. The examples applying the general solution to solve several simple inverse problems in elastostatics are presented. (Paper received 19 Dec 84.)

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THE FINITE ELEMENT TECHNIQUE FOR PREDICTING THE NATURAL FREQUENCIES, MODE SHAPES AND DAMPING VALUES OF FILAMENTARY COMPOSITE PLATES

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 2, Feb 86 pp 181-196

[English abstract of article by Lin Dunxiang [2651 2415 4382] of Shanxi Institute of Mechanical Engineering, Xi'an, and Ni Ronggen [0242 2837 2704] of Institute 621, Ministry of Aeronautics Industry, Beijing]

[Text] This article presents the numerical method for predicting the natural frequencies, mode shapes and damping values of filamentary composite plates. This method is based on finite element technique, using damped element and allowing transverse shear deformation. For the example of this technique, the theoretical results comparing with experimental values of carbon fibre and glass fibre reinforced plastics plates (mid-plane symmetric) are provided. The dynamic properties of these laminates are discussed. Finally, a simple graphic technique to estimate the natural frequencies and damping values is suggested. (Paper received 27 May 83.)

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THE METHOD OF MIXED BOUNDARY CONDITION FOR A KIND OF LINEAR AND NONLINEAR
COMPOSITE STRUCTURE

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in
Chinese Vol 7 No 3, Mar 86 pp 215-224

[English abstract of article by Chen Shanlin [7115 1472 2651] of Chongqing
Institute of Architecture and Engr., Chongqing, and Zhang Liying [1728 4539
5391] of Chongqing Jiaotong Institute, Chongqing]

[Text] This paper deals with the axisymmetrical deformation of shallow shells
in large deflection, which are in conjunction with linear elastic structures
at the boundary. A method of mixed boundary condition for this problem is
introduced, then the problem of a composite structure is transformed into a
problem of a single structure and the integral equations are given. The
perturbation method is used to obtain the solutions and an example of composite
structure consisting of a shallow spherical and a cylindrical shell is present-
ed. Calculations were carried via Cromemco System-III microcomputer. (Paper
received 1 Sep 85.)

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PLASTIC ANALYSIS OF THIN PLATES WITH ANISOTROPIC HARDENING

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7. No 3, Mar 86 pp 225-234

[English abstract of article by Jing Yongjie [6855 3057 2638] of Department of Engineering Mechanics, Shanghai Jiaotong University, Shanghai]

[Text] In this paper we discuss the adoption of the anisotropic hardening model due to the existence of Bauschinger effect when thin plate is applied by repeated loading. The loading condition of thin plates for linear kinematic hardening has been deduced in terms of generalized forces and generalized plastic deformation. And it can be extended to nonlinear kinematic hardening and mixed hardening. Finally as an example the numerical results are obtained for a circular plate. (Paper received 10 Feb 85.)

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NONLINEAR OSCILLATION OF A TWO-DIMENSIONAL LIFT BODY

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7, No 3, Mar 86 pp 235-238

[English abstract of article by Wang Maohua [3076 2021 7520] of Beijing Institute of Aeronautics and Astronautics, Beijing]

[Text] It is very difficult to obtain an exact analytical solution to a nonlinear ordinary differential equation, so till now analytical solutions are rare in this area. The author has obtained the exact analytical solutions of this type of nonlinear oscillations. In this paper as an example, the exact analytical solution of nonlinear oscillation of a two-dimensional lift body, which has attracted the attention of research workers for a long time, is given. (Paper received 29 Jan 85.)

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CONTACT PROBLEM OF RUBBER RINGS WITH LARGE DEFORMATION

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 3, Mar 86 pp 239-248

[English abstract of article by Lu Hexiang [0712 0735 4382] of Department of Engineering Mechanics, Dalian Institute of Technology, Dalian]

[Text] A combined problem with frictional contact between a rubber ring with large deformation and linear elastic thin plate is solved by means of the substructuring technique. A study of the influence of frictional coefficient and the influence of plate thickness is presented. (Paper received 13 Sep 84.)

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ON PROBLEMS OF OPTIMAL DESIGN OF SHALLOW SHELL WITH DOUBLE CURVATURE ON ELASTIC FOUNDATION

Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 7 No 3, Mar 86 pp 259-263

[English abstract of article by Cheng Xiangsheng [2052 4382 3932] of Tongji University, Shanghai]

[Text] The present paper discusses a method of optimal design of the shallow shell with double curvature on the elastic foundation. Substantially we take the initial flexural function as the control function or design variable which will be found and the potential energy of the external loads as the criterion of quality of the optimal design of the shallow shell with double curvature, therefore the functional of the potential energy will be aim function. The optimal conditions and the isoperimetric conditions belong to the constrained conditions, thus we obtain the necessary conditions of the optimal design for the given problems, at the same time the conjugate function is introduced, then the problems are reduced to the solutions of two boundary value problems for the differential equation of conjugate function and the initial flexural function. (Paper received 28 Apr 83.)

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Astronomy

DETERMINATION OF ERP WITH LLR DATA

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 27 No 2,
Jun 86 pp 85-95

[English abstract of article by Jin Wenjing [6855 2429 2417] and Wang Qiangguo [3769 1730 0948] of the Shanghai Observatory, Chinese Academy of Sciences]

[Text] In this paper a comparison between the results (JD2443915.23-2443940.86) calculated by us and those of other analysis centers is listed in a table. Four questions are discussed as follows:

1. The influence of adopted initial values of UT1-UTC, x , y , is discussed. If the initial value of UT1-UTC sets to zero or equals that of Circular D of BIH, the same values of UT1-UTC can be obtained by iterating two times.

When the X , y values used deviate from those of BIH to $0.02''$, the influence of UT1-UTC may be 0.5 ms as listed in the table. Because the accuracy of x , y supplied by BIH is better than $0.01''$, it is reasonable to adopt x , y from Circular D of BIH for determination of UT1-UTC using the LLR data at a single station.

2. The influence of adopted spherical station coordinates (λ , ϕ , r) has been analyzed and the results are listed in a table.

3. The influence of the adopted constants of lunar physical libration is analyzed. Two sets of the adopted value, MERIT Standards and the Eckhart-500 are used for UT1-UTC calculation. The results are listed in a table.

4. The choice of pre-residual or post-residual to determine UT1-UTC is also discussed. If the pre-residual is used for UT1-UTC calculation, then the initial reference system is adopted, while the post-residual corresponds to the corrected reference system (the initial parameters plus the corrected value obtained from adjusting a series of lunar observations). If the results between different analysis centers are to be compared, the pre-residual should be adopted.

The UT1-UTC values calculated from the LLR data in the main MERIT Campaign using our method and that of JPL are listed in a table.

CERGA (Grasse, France) and MLRS, used instead of McDonald's 2.7 m telescope, began regular observation of LLR in July 1982 and September 1983 respectively. There are two stations in the world which operate the LLR program in the main MERIT Campaign and whose longitudinal difference is about 111° . This means that the possibility of solving the three parameters of ERP now exists.

Due to the uncorrected station coordinates and the systematic error of observation, the systematic error should be reduced for ERP calculation.

In determining the ERP, each observational equation should be given a suitable weight based on the rms of the normal point (internal weight) and the square error (external error) obtained from adjusting the observations of LLR after about one year. This will ensure that the difference between p_{in} and p_{ex} is not obvious. The results are listed in a table.

Using the LLR data at two stations, Grasse and McDonald, in the main MERIT Campaign, the corrected station coordinates and the baseline length between the two stations are also obtained and listed in the tables. The precision is 10-50 cm and 20-40 cm respectively.

In determining the ERP, regular observations of LLR will be expected at these two stations or others which already have the observation conditions.

ON OPTIMAL CONDITIONS FOR DETERMINATION OF EARTH ROTATION PARAMETERS

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 27 No 2,
Jun 86 pp 96-105

[English abstract of article by Zhao Ming [6392 6900] and Zhu Shengyuan [2612 5110 3298] of the Shanghai Observatory, Chinese Academy of Sciences]

[Text] There are various techniques used for determination of Earth Rotation Parameters (ERP). The basic observation principle for all these techniques is the same, i.e., the observation of generalized zenith distance. In this paper an observation equation suitable for all techniques is given, and the most favorable situation for determining generalized zenith distance is discussed. Under the assumption that all the equivalent observables have the same weight, the optimal conditions for determining ERP are reduced from the general observation principle. The results look very simple, yet they can be widely used for all techniques. It is also shown that, to obtain the optimal ERP, the distribution of the source vector is as important as that of the station vector.

INFLUENCE OF ATMOSPHERIC ZONAL TIDES ON EARTH'S ROTATION RATE

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 27 No 2,
Jun 86 pp 106-112

[English abstract of article by Zhu Yaozhong [2612 5069 0112] of the Institute
of Geodesy and Geophysics, Chinese Academy of Sciences]

[Text] Using the daily atmospheric pressure data obtained at Harbin, Beijing, Wuhan and Guangzhou meteorological stations during 1979-1983, the atmospheric zonal tidal effect is analyzed by means of the AR spectrum. In this paper, the response of the oceans to the variations in atmospheric pressure is discussed in four cases. The parameter K/c , which is proportional to the variation in the Earth's rotation rate, is solved. The main results are as follows:

1. If there were no oceanic responses to the variations in atmospheric pressure, then $K/c = 1.005$.
2. If all gravitational and deformational effects on the oceans due to the variations in atmospheric pressure are ignored, then $K/c = 0.966$.
3. If the gravitational and deformational effects are included, then $K/c = 0.969$.
4. In order to contribute to the effective Love number K , the inverted barometer and constant response should be about 36 percent of the solution in which the oceans are assumed to be freezing. The gravitational and deformational effects on sea level are about 14 percent of the pressure-induced effects. The atmospheric zonal tides are about 2 percent of the Earth tides.

CHORD AND RELATIVE HEIGHT ESTIMATION FROM SINGLE PASSES OF SATELLITE LASER
RANGING DATA

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 27 No 2,
Jun 86 pp 113-120

[English abstract of article by He Miaofu [0149 1181 4395] and Feng Chugang
[7458 0443 0474], et al., of the Shanghai Observatory, Chinese Academy of
Sciences]

[Text] The application of the multiple-very short arc technique to
determining the chord and relative height between two laser tracking stations
from single passes of satellite laser ranging data is described. It is
shown through experiments that this technique for processing laser ranging
data can be regarded as an important supplement to the conventional dynamic
technique which requires more observations collected over several consecutive
satellite revolutions. Consequently, while the scale and orientation of the
interstation base line are provided by the dynamic technique using longer arcs
of the satellite laser ranging data, the multiple-very short arc technique
described here offers a useful method of checking the accuracy of the
geodetic network consisting of the laser tracking stations.

9717

CSO: 4009/111

Electronics

SOME RESULTS OF THE RESEARCH ON THE FLUTE-TYPE HOLLOW CATHODE DISCHARGE USING
A LOW-LIGHT LEVEL TV CAMERA

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7 No 5,
Sep 85 pp 323-328

[English abstract of article by Wang Yuzhi [3769 2948 4249], and Wei Cong [7279
3829] of Chengdu Institute of Radio Engineering]

[Text] The breakdown processes of the flute-type hollow cathode discharge was observed by a low-light level TV camera of the SEM (Silicon Electron Multiplification) type, the most sensitive one of low-light level cameras of modern industry. An explanation for the mechanism of light development was presented. The light development was divided into two stages, i.e., the stage (1st stage) of self-sustained dark discharge developed in the space between the anode bar and the outer-side of the flute tube, and the stage (2nd stage) of entering of discharge through the hole into the flute tube. Corresponding to the two stages, there are two γ -processes, one existing at the metal surface around the hole and the other at the inner surface of the cathode. According to the above results, a discussion on the current principle of the design of geometrical parameters of the flute type was given. (Paper received 7 Feb 85.)

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IMPULSE RESPONSES OF APERTURE ANTENNAS WITH ARBITRARY APERTURE DISTRIBUTIONS

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7 No 5,
Sep 85 pp 348-355

[English abstract of article by Hu Hannan [5170 3352 0589] of Shanghai Ship
and Shipping Research Institute]

[Text] Based on the equation of Fresnel-Kirchhoff scalar diffraction field, impulse responses of parallel-fed aperture antennas of arbitrary configurations with arbitrary aperture amplitude distributions and those of end-fed rectangular aperture antennas with arbitrary aperture amplitude distributions can all be expressed in the aperture amplitude distributions, and that the impulse responses of rectangular aperture antennas with separable aperture distributions and those of circular aperture antennas with circularly symmetric distributions are special cases of the above general ones. (Paper received 23 Dec 83, finalized 20 Dec 84.)

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DESIGN AND PERFORMANCE OF COMPACT LOW NOISE GaAs MESFET AMPLIFIERS FOR UHF OPERATION

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7. No 5, Sep 85 pp 374-380

[English abstract of article by Wang Wenqi [3769 2429 7496] of Shanghai University of Science and Technology, Branch, and Yang Xinmin [2799 2450 3046], et al., of Shanghai Institute of Metallurgy, Academia Sinica]

[Text] The design considerations and experimental results of compact low noise GaAs MESFET amplifiers for UHF operation were described. The miniaturized and optimized circuits were obtained by means of special matching network and CAD technique. Both two-stage unit at 700 MHz and three-stage unit of 1000 MHz were fabricated on 50x60 mm² alumina substrate, and the power gain of 29 and 30 dB, noise figure of 0.8 and 1.2 dB and bandwidth of 40(3 dB) and 100 MHz (1 dB) were obtained, respectively. The satellite direct broadcasting receiver constructed with the 700 MHz GaAs MESFET amplifier has clear pictures and good sound.

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A MICROWAVE SWITCH WITH OPTIONAL POWER DIVISION RATIO

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7 No 5,
Sep 85 pp 385-390

[English abstract of article by Zheng Dunxiang [6774 2415 4382] of Beijing
Aircraft Maintenance Engineering Development Corporation]

[Text] A microwave switch with optional power division ratio, which uses PIN diode for controlling, is introduced. Analytic formulas are given. They are straight-forward and feasible for engineering purposes. The theoretical analysis is in good agreement with the experimental result. (Paper received 21 Mar 84, finalized 14 Nov 84.)

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PIEZOELECTRIC CERAMICS WITH $k_p=0.15$

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7 No 5, Sep 85 pp 391-392

[English abstract of article by Zhang Hanjun [1728 3352 0689] of Guangzhou Communication Institute]

[Text] $\text{PbNb}_2\text{O}_6\text{-PbCrO}_4\text{-PZT}$ piezoelectric ceramics with low radial coupling coefficient has been developed. Its chemical equation is given. This kind of ceramics is characterized by $k_p=0.15$, $Q_m=5000$, $\Delta f/f_r=6\times 10^{-6}$. It has been used successfully to make low-frequency narrow-band ceramic filter. (Paper received 4 Jan 85.)

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THE STUDY OF LATTICE MATCH IN GaInAsP/InP HETEROJUNCTION LPE LAYERS

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 7 No 5,
Sep 85 pp 395-400

[English abstract of article by Yang Yi [2799 2496], et al., of Shanghai Institute of Metallurgy, Academia Sinica]

[Text] The effects of the growth conditions of two-phase solution liquid phase epitaxy (LPE) (i.e. growth temperature, cooling rates and solution composition) on lattice mismatch and bandgap wavelength in GaInAs/InP heterojunction LPE layers have been investigated by X-ray double-crystal diffractometry and double-beam spectrophotometer. The interface stress in the grown interface free of misfit dislocations and the lattice mismatch at growth temperature have been calculated. (Paper received 25 Jul 83, finalized 20 Aug 84.)

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CSO: 4009/1108

Engineering

A FEASIBILITY STUDY OF ON-LINE MONITORING FOR THE BURN OF GROUND SURFACE LAYER

Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY]
in Chinese Vol 16 No 3, Jul 86 pp 1-10

[English abstract of article by Shi Xiurong [2514 0208 2837] and Huang Ren
[7806 0088] of Department of Mechanical Engineering]

[Text] This paper discusses the burn of ground surface layer in the view of surface integrity and demonstrates that the governing factor of influence is grinding temperature. A method to study for on-line controlling or monitoring the burn of ground surface layer via grinding spark temperature by the maximum entropy spectrum and infrared system and optical fibre/infrared system is proposed.

The results of investigations prove that the grinding process represented by the grinding sparks temperature is stationary and regularities of the clustered sparks ray temperature quite agree with the grinding temperature. When the ground surface layer has been burned, the characteristics of the spark ray temperature can be identified via maximum entropy spectral analysis. (Paper received 13 Jul 85.)

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KINEMATIC ANALYSIS OF 7R MULTI-JOINT MANIPULATORS

Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY]
in Chinese Vol 16 No 3, Jul 86 pp 11-20

[English abstract of article by Jin Wanmin [6855 8001 2404] of Department of
Mechanical Engineering]

[Text] The rotational transformation matrix method and relevant equations
derived by Hiroshi Makino are used to solve the indirect position problems
of manipulators. This method is simple and generally accepted and convenient
to computerize. (Paper received 4 Mar 85.)

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DECOUPLED BRANCH DIFFERENCE LOAD FLOW FORMULATION

Part 1: Algorithms

Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY]
in Chinese Vol 16 No 3, Jul 86 pp 76-82

[English abstract of article by Shan Yuanda [0830 3220 6671], et al., of Dept.
of Electrical Engineering]

[Text] This paper presents a new model or formulation for ac-load flow problem in terms of branch angle and voltage differences. This model is linear in these variables and quadratic to branch losses, thus yielding a formulation particularly suitable to linear and quadratic programming techniques.

In addition, this new formulation yields a symmetric A matrix even in the most general case where phase-shifters are present in the transmission system. Moreover, the decoupled coefficient matrix involves only branch susceptance. These features offer very important computational simplifications.

The 14, 11, 30, 57 and 118 bus systems are included as examples to illustrate the validity of the new model. (Paper received 11 Mar 85.)

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DECOUPLED BRANCH DIFFERENCE LOAD FLOW FORMULATION

Part 2: Alleviation of Ill-Conditioned Load-Flow Problems via the Decoupled Branch Difference Formulation

Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY]
in Chinese Vol 16 No 3, Jul 86 pp 83-92

[English abstract of article by Shan Yuanda [0830 3220 6671], et al., of Dept. of Electrical Eng.]

[Text] This paper presents a simplified index to recognize ill-conditioning for the basic linear equations and power system analysis problems. A new load-flow formulation is then presented. A key advantage of this new decoupled branch difference (DBD) load-flow algorithm is its ability to both recognize the physical parameters causing ill-conditioning, and thereby through a simple procedure to numerically eliminate the ill-conditioning. Test results on seven systems, four of which are taken from the literature of ill-conditioned power systems, are presented. (Paper received 11 Mar 85.)

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A STUDY ON AQUATIC ACTINOMYCETES IN THE PLATEAU LAKES IN YUNNAN

VIII. IDENTIFICATION OF THE GENUS ACTINOMADURA

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26
No 2, Jun 86 pp 97-100

[English abstract of article by Jiang Chenglin [1203 2052 2651], and Xu Lihua [1776 7787 5478] of Yunnan Institute of Microbiology, Kunming]

[Text] Twelve strains belonging to the genus Actinomadura were isolated from the mud samples collected from Chenghai Lake in Yunnan. Two of them were described as two new species: Actinomadura chenghaiensis sp. nov. and Actinomadura viridoflava sp. nov. (Paper received 8 Apr 85.)

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THE TWO NEW SUBSPECIES OF STREPTOMYCES

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26. No 2, Jun 86 pp 101-104

[English abstract of article by Zhang Guowei [1728 0948 0251], et al., of Institute of Microbiology, Academia Sinica, Beijing, and Zhu Guiru [2612 2710 1172], et al., of Northwest Plateau Institute of Biology, Academia Sinica, Xining]

[Text] The A614, A3, and other strains was isolated from soils of Qing-Zang highland. The A614 was identified and named *Streptomyces rubiginosohelvolus* subsp. *pallens* n. subsp. The A3 was identified and named *Streptomyces galilaeus* subsp. *xiningensis* n. subsp. (Paper received 15 Jun 84.)

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STUDIES ON THE STREPTOMYCES OF HYGROSCOPICUS GROUP

IV. IDENTIFICATION OF TWO NEW SPECIES

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26.
No 2, Jun 86 pp 105-111

[English abstract of article by Zhou Qi [0719 0796] and Lin Kaichun [2651 7030 2504] of Agricultural Antibiotic Laboratory, Huazhong Agricultural University, Wuhan]

[Text] Two new species (type strain SH-121 and SH-4) of hygroscopticus group of Streptomyces, isolated from soil of Fangxian, province Hubei of China were found to produce antibiotics which are effective in preventing and controlling the citrus diseases during storage caused by *Penicillium italicum*, *P. digitatum*, *Alternaria citri* and *Geotrichum candidum*.

Strain SH-121: Spore-chain morphology belongs to section Retinaculum-Apertum (RA). Spore surface is smooth. In comparison with all the known species of Streptomyces, the strain SH-121 seems to resemble *S. hygroscopticus* f. *glebosus* Ohmori et al.. However, it has significant differences from the above organism in the following aspects: the color of substrate mycelium on the synthetic media and natural organic media, physiological properties, utilization of carbon sources and the production of antibiotics. As a result of the above mentioned characteristics, the designated as *Streptomyces carneohygros copicus* n. sp.

Strain SH-4: Spore-chain morphology belongs to section spirales with the tightly spiral tail, which likes sporangium. Spore surface is smooth. There are masses of spores enclosed by mucous substance in the middle or on the top of spore-chain. This strain has been found to belong to the hygroscoptic group of Streptomyces, but differs from all known species of the group. It is considered as a new species and designated as *Streptomyces glomeroplatensis* n. sp. (Paper received 15 Feb 85.)

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ELECTRON MICROSCOPIC STUDY OF THE MORPHOLOGY OF VIRUS OF HAEMORRHAGIC FEVER
WITH RENAL SYNDROME IN SUCKLING MICE

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26
No 2, Jun 86 pp 112-115

[English abstract of article by Chen Dehui [7115 1795 5610], et al., of Institute of Basic Medical Sciences, Academy of Military Medical Sciences, Beijing, and Ni Dashi [0242 1129 4258], et al., of Institute of Medical Sciences of Anhui Province, Hefei]

[Text] Two-three-day old mice were inoculated with ALC96 strain HFRS virus. Routine ultrathin sections of infected mouse brain tissues were examined in electron microscope.

Four days after inoculation an increase in the amount and complexity of membranes and vacuoles of the Golgi apparatus in infected nerve cells occurred predominantly. Later (8 and 10 days after inoculation) a small number of matured virions were found within the distended Golgi sacculus and vesicalae of infected neurons. Most of viral particles observed in ultrathin sections were round or oval in shape and 70-110 nm in diameter. A lipid bilayered viral envelope with an external fringe of surface projections could be resolved at high magnification. The mode of maturation of the virus involved budding from cytoplasmic membrane into Golgi vesiculae.

The known morphological and morphogenetic findings of virus particles observed in mouse brain tissue gave the further evidence for taxonomic identification of HFRS virus as a member of the family Bunyaviridae. (Paper received 15 Feb 85.)

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CONSTRUCTION AND CHARACTERIZATION OF THE pCN HYBRID PLASMID FOR YEAST GENETIC ENGINEERING VECTOR

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26
No 2, Jun 86 pp 127-133

[English abstract of article by Ni Jin [0242 3160], et al., of Institute of Microbiology, Academia Sinica, Beijing]

[Text] By means of the DNA recombinant technology, pCN plasmids were constructed from plasmids YRp7 and pAT153 for yeast genetic engineering vector. The pCN plasmids consist of 1.4 Kb DNA segment of yeast TRP1 gene and the intact plasmid pAT153 molecule. There are two different configuration of pCN plasmids, according to the orientation of inserted TRP1 DNA segment in pAT153 plasmid. The pCN vector obtains the properties of high transformation efficiency of YRp7 and high copy level of pAT153, furthermore, the stability of the pCN plasmid in yeast recipient is more than that of the YRp7. As a shuttle plasmid between yeast and *E. coli*, especially pCN60 from pCN plasmids can be used as yeast genetic engineering vector. (Paper received 8 May 85.)

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THE PLASMIDS CARRING CRYSTAL PROTEIN GENE OF BACILLUS THURINGIENSIS AND THEIR TRANSFER BETWEEN VARIOUS STRAINS

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26
No 2, Jun 86 pp 143-150

[English abstract of article by Li Rongsen [2621 2837 2773] of Wuhan Institute of Virology, Academia Sinica, Wuhan]

[Text] The patterns of plasmids from 19 strains of *Bacillus thuringiensis* representing 7 subspecies were investigated by agarose gel electrophoresis. It was shown that the composition of plasmids of *Bacillus thuringiensis* was not only subspecies-specific but also strain-specific. The size of the plasmids associated with formation of the crystal protein was 42 and 50 Mdal in HD-191 (*B. thuringiensis* var *kurstaki*), 47 Mdal in HD-282 (*B. thuringiensis* var. *aizawai*), and 57 Mdal in IPS-82 (*B. thuringiensis* var. *israelensis*). The crystal protein gene of strain 140 (*B. thuringiensis* var. *wuhanensis*) was most possibly not located in plasmid, but in chromosomal DNA. The plasmid carrying the crystal protein gene of the HD-191 was transferred into the mutant HD-1 ($sp^+ cr^-$) in high frequency and the gene encoding for crystal protein was expressed in the cells of HD-1. Transfer of the plasmid associated with crystal protein gene into cells of the IPS-82 from HD-1 ($sp^+ cr^-$) had failed, suggesting some incompatibility of the plasmid between them. (Paper received 5 Apr 85.)

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THE CONDITIONS OF AMPICILLIN ACYLASE PRODUCTION BY AS 1.586

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26
No 2, Jun 86 pp 154-159

[English abstract of article by Han Wenzhen [7281 2429 3791], et al., of
Institute of Microbiology, Academia Sinica, Beijing]

[Text] An ampicillin acylase producing strain of *Corynebacteria pekinense* was selected, and conditions for the production of ampicillin acylase have been investigated. The suitable medium consisted of mono sodium glutamate 0.2 percent, yeast extract 0.2 percent. $K_2HPO_4 \cdot 3H_2O$ 0.3 percent, $MgCl_2 \cdot 6H_2O$ 0.1 percent, $FeSO_4 \cdot 7H_2O$ 0.01 percent, glucose 2 percent, $CdSO_4 \cdot 3H_2O$ 0.1 percent, beef peptone 0.7 percent, pH 7.0. The optimal condition for enzyme production are as follows: 250 ml shake filled with 30 ml fermentation medium, 28°C, incubation period 24 h. Under such conditions, highest ampicillin acylase activities was about 5.4 u/ml. (Paper received 5 Feb 85.)

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A STUDY ON ULTRA-LOW TEMPERATURE FREEZING OF BACTERIAL CULTURES

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26.
No 2, Jun 86 pp 164-169

[English abstract of article by Ma Yansheng [7456 1693 3932] of Institute of Microbiology, Academia Sinica, Beijing]

[Text] Response of the 19 bacterial strains belonging to 19 species in 10 genera subjected to liquid nitrogen freezing and thawing was reported. According to the cell survival rate, the protective efficiency of 10 percent glycerol and 10 percent DMSO was superior to distilled water after preservation at frozen state for 8 months. Only a few strains showed similar survival rate when they were protected with glycerol, DMSO or water. Rapid or slow freezing has no distinct effect on their viability. The high survival rate may be obtained with dense cell suspensions of *Acetobacter rancens* var. *turbidans* AS 1.41 and *Brevibacterium ammoniagenes* AS 1.844. *Aerobacter aerogenes* AS 1.489 was sensitive to freezing resulting to the lysis of cells as illustrated by electron microscopy.

After freezing and thawing, it was shown that the suspensions were transferred into test media, the lactic acid producing ability of *Lactobacillus plantarum* AS 1.557 and the sensitivity of *Micrococcus lysodeikticus* AS 1.634 to lysozyme were reduced. However, the ability of *Corynebacterium crenatum* AS 1.998 for L-isoleucine production, *Escherichia coli* AS 1.76 for penicillin acylase activity, *Pseudomonas aeruginosa* AS 1.647 for 2-keto-L-gulonic acid, and *Lactobacillus plantarum* AS 1.557 for lactic acid were not reduced when the frozen and thawed strains were activated. (Paper received 11 Oct 84.)

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SUCCESS IN ESTABLISHING THE MSHA-POSITIVE PSEUDOMONAS AERUGINOSA FIMBRIAL STRAIN

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26.
No 2, Jun 86 pp 176-179

[English abstract of article by Mu Xiya [3664 1585 0068] of Department of Microbiology, Dalian Medical College, Dalian]

[Text] The author had successfully selected breeding a MSHA-positive *Ps. aeruginosa* fimbrial strain on April, 1984. This new MSHA-positive fimbrial strain was isolated and selected from clinical specimens.

It has strong MSHA and yeast agglutination characteristics. Up to more than one year, after propagating many generations, it still persists its main properties.

This fimbrial strain may be used as a standard positive control for fimbrial investigation in many area including microbiology, immunology, infection, epidemiology, etiology and genetics, etc. (Paper received 7 Dec 84.)

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TO INQUIRE INTO THE CLASSIFIABLE POSITION OF STREPTOMYCES ERYTHREUS 2577

Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 26.
No 2, Jun 86 pp 180-183

[English abstract of article by Wang Qianxing [3769 6197 5281], and Chen Xiaoqing [7115 5135 1987], of Sichuan Industrial Institute of Antibiotics, Chengdu, and Deng Yuxiu [6772 1342 4423] and Yan Xunchu [7051 6676 0443] of Institute of Microbiology, Academia Sinica, Beijing]

[Text] A erythromycin-producing strain previously named as *Streptomyces erythreus* 2577 was found having the chemical composition of cell wall of type IV and partly fragmented substrate mycelium and aerial spore chains of *Streptomyces* type. It has thick cell wall. The strain 2577 therefore is considered to belong to the genus *Saccharopolyspora* and renamed as *Saccharopolyspora erythrea* 2577 (Wakman & Curtis 1916; Waksman & Henrici 1948) Deng & Wang n. comb. 1984. (Paper received 21 Jan 85.)

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Neurology

Na, K⁺-ATPASE ACTIVITY OF ERYTHROCYTE MEMBRANES IN PROGRESSIVE MUSCULAR DYSTROPHY

Beijing ZHONGHUA SHENJING-JINGSHENKE ZAZHI [CHINESE JOURNAL OF NEUROLOGY AND PSYCHIATRY] in Chinese Vol 19 No 3, 23 Jun 86 pp 129-131

[English abstract of article by Shen Dingguo [3088 1353 0948], et al., of the PLA General Hospital]

[Text] A study of the Na⁺+K⁺ ATPase activity of erythrocyte membranes in 34 patients with Duchenne's (pseudohypertrophic) muscular dystrophy and limb-girdle muscular dystrophy and also in 6 patients with infantile spinal muscular atrophy has been conducted. The control group consisted of 60 normal subjects of various ages. The results showed that in the control group the Na⁺+K⁺ ATPase activity was lower in normal children than in young adults and the same was true of the inhibitory reaction of ouabain on Na⁺+K⁺ ATPase activity. In the matched age groups of Duchenne's muscular dystrophy, the ATPase activity was found to be much lower while the inhibitory reaction of ouabain was increased. In cases of limb-girdle dystrophy, the ATPase activity was also lower, although the inhibitory reaction of ouabain did not reach the values of the normal subjects. However, neither the Na⁺+K⁺ ATPase activity nor the inhibitory reaction of ouabain showed any significant differences between the values found in infantile spinal muscular atrophy and those in the controls. This would seem to indicate that the presence of an enzyme defect might be shared by patients with Duchenne's muscular dystrophy and limb-girdle muscular dystrophy. (Paper received 28 March 1983, finalized 10 April 1985.)

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COMPUTERIZED SPECTRAL ANALYSES OF EEG IN PATIENTS WITH CEREBRAL THROMBOSIS

Beijing ZHONGHUA SHENJING-JINGSHENKE ZAZHI [CHINESE JOURNAL OF NEUROLOGY AND PSYCHIATRY] in Chinese Vol 19 No 3, 23 Jun 86 pp 136-137

[English abstract of article by Wu Xun [0702 6676] of Beijing Medical College; et al.]

[Text] The results of visual and computerized spectral analyses of the EEGs of 18 patients with cerebral thrombosis have been compared. Localized abnormalities were found in 7 of the 18 (38.9 percent) by visual analysis and in 12 of the 18 (66.7 percent) by computerized spectral analysis. Among 12 patients in the acute stage of the disease, localized abnormalities were observed in 6 of the 12 (50 percent) under visual analysis and in 10 of the 12 (83 percent) under computerized spectral analysis. Among six patients in the recuperative stage, localized abnormalities were seen in one of the six by visual analysis and in two of the six by computerized spectral analysis. The authors believe computerized spectral analysis can raise the positive rate of localized abnormalities in the EEGs of patients with cerebral thrombosis. (Paper received 3 November 1984, finalized 16 March 1985.)

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CYTOGENETIC CHANGES IN 48 CASES OF SCHIZOPHRENIA

Beijing ZHONGHUA SHENJING-JINGSHENKE ZAZHI [CHINESE JOURNAL OF NEUROLOGY AND PSYCHIATRY] in Chinese Vol 19 No 3, 23 Jun 86 pp 188-191

[English abstract of article by Hong Meiling [3163 5019 3781], et al., of the Military Medical School, Shenyang Unit, PLA; et al.]

[Text] A preliminary study in the field of cytogenetics was made in a group of 48 cases of schizophrenics, with 37 volunteers as the normal control group. Pericentric inversion of chromosome 9 was confirmed by c-band and G-band techniques in 10 cases of the patient group, whereas only 1 was found in the control group ($P > 0.05$). As documented in the previous literature, schizophrenic patients tend to have a higher occurrence rate of pericentric inversion of chromosome 9, indicating that there is a possible correlation between this sort of chromosomal abnormality and the pathogenesis of schizophrenia. In addition, 3 of the 10 cases studied were twins. All the twin brothers suffered from psychoses. Two of the three pairs of twins were monozygotic with paranoic schizophrenia. Pericentric inversion of chromosome 9 may exert some pathogenetic significance. (Paper received 10 September 1984, finalized 23 May 1985.)

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CSO: 4009/1097

Oncology

REGIONAL DISTRIBUTION OF LIVER CANCER AND ITS RELATION TO SELENIUM LEVEL IN
QIDONG COUNTY, CHINA

Beijing ZHONGHUA ZHONGLIU ZAZHI [CHINESE JOURNAL OF ONCOLOGY] in Chinese Vol 8
No 4, 23 Jul 86 pp 262-264

[English abstract of article by Li Wenguang [2621 2429 1639], et al., of Qidong
Liver Cancer Institute, Jiangsu, and Yu Shuyu [0060 2885 3768], et al., of
Cancer Institute, Chinese Academy of Medical Sciences, Beijing]

[Text] The selenium (Se) level in barley and maize from 43 communes of Qidong
county, a high risk area of liver cancer in China, were assayed. An inverse
correlation between the Se level and the liver cancer incidence was observed.
An inverse correlation was also observed between the blood Se level and liver
cancer incident of the local residents. When selenite solution was sprayed
on the crops during their preflowering, the content of Se in barley and maize
was increased by 6 fold over the control. It is suggested that the increase
of blood Se level of the residents who live in the low-Se areas by this method
be useful in the prevention of liver cancer. (Paper received 29 Jan 85, final-
ized 27 May 85.)

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DEVELOPMENT OF OCCULT THYROID CARCINOMA

Beijing ZHONGHUA ZHONGLIU ZAZHI [CHINESE JOURNAL OF ONCOLOGY] in Chinese Vol 8
No 4, 23 Jul 86 pp 280-282

[English abstract of article by Zhang Zhida [1728 1807 6671] of Nanjing Air Force Hospital, Nanjing]

[Text] Developmental features of 16 patients with occult thyroid carcinoma less than 1.0 cm in diameter as collected from our surgical specimens are described. They are classified into 3 types: non-capsular sclerosis, capsular non-sclerosis and non-capsular non-sclerosis types. Non-capsular non-sclerosis type is the developmental form at early stage. Tumors that grow rapidly and to which the host has a strong reactivity tend to change into the non-capsular sclerosis type. On the contrary, those which grow slowly to which the host is weak in reaction tend to change into the capsular non-sclerosis type. The relation between the histological classification and developmental form is discussed. (Paper received 12 Dec 85.)

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Optics

16 μ m CW PbSnSe SEMICONDUCTOR TUNABLE LASERS AND THEIR USES IN HIGH RESOLUTION SPECTROSCOPY

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 7, Jul 86 pp 592-597

[English abstract of article by Wang Hailong [3769 3189 7893], et al., of Shanghai Institute of Optics and Fine Mechanics, Academia Sinica]

[Text] We report the tuning characteristics of 16 μ m CW PbSnSe diode lasers. We have measured CO₂ absorption spectra near 618cm⁻¹, 623cm⁻¹, 634cm⁻¹ and 667 cm⁻¹ as well as N₂O absorption spectra near 618cm⁻¹ and 588cm⁻¹. These results show that the mode quality of these lasers is high and the single-mode tuning range is wide.

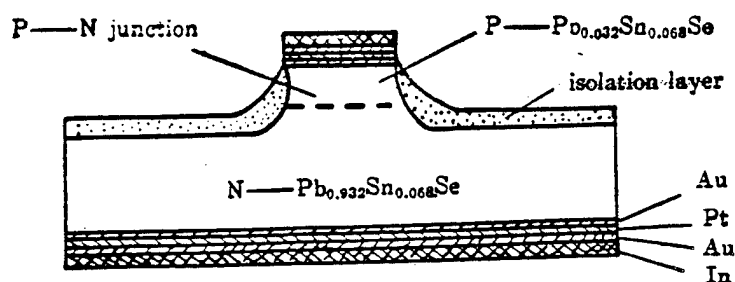


Fig. 1 Schematic diagram of a PbSnSe homojunction laser with stripe-geometry

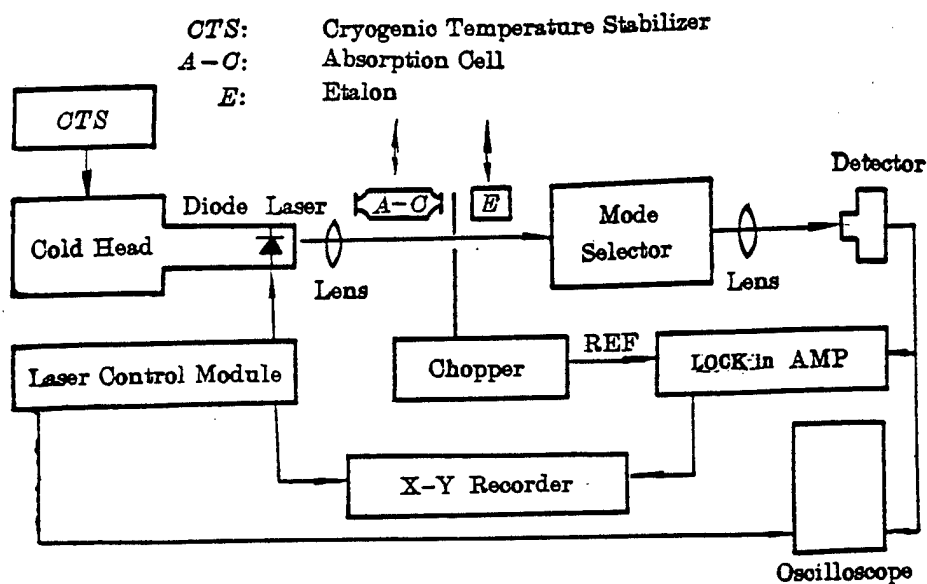


Fig. 5 Schematic diagram of a high-resolution spectrometer using a diode laser

(Paper received 21 Nov 85.)

A NEW METHOD FOR SUPPRESSING RAYLEIGH NOISE IN AN OPTICAL FIBER GYROSCOPE

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 7, Jul 86
pp 630-636

[English abstract of article by Cao Xuelong [2580 7185 7893], et al., of Shanghai University of Science & Technology, Shanghai Institute of Optical Fibre Technology and Modern Communication]

[Text] After making analysis of Rayleigh noise characteristics in an optical fiber gyroscope, we developed a new method to suppress the noise. Theoretically, we found that with this method the Rayleigh noise can be suppressed by a factor of $|J_0(\phi_m)|$, here $J_0(x)$ is the zeroth-order Bessel function and ϕ_m the modulation amplitude. Therefore, with a proper modulation the noise can be reduced to zero. This new method is simpler and more effective than that using band-pass noise phase modulation.

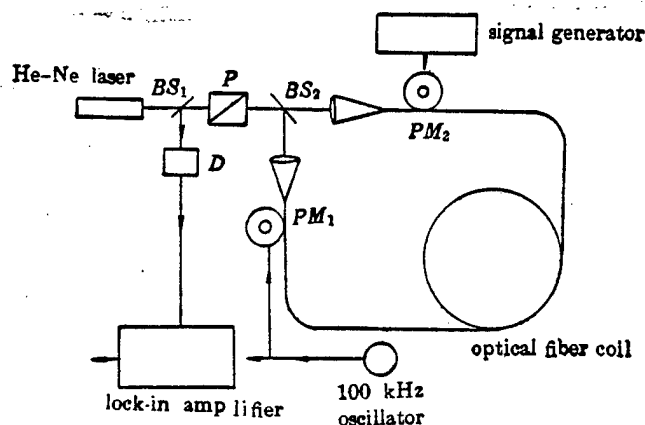


Fig. 1 Experimental setup of an optical fiber gyroscope

(Paper received 9 Oct 85, finalized 9 Dec 85.)

ANALYSIS OF THE REFLECTION WAVE OF CONE BEAM FROM A MULTILAYER THIN FILM

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 6 No 7, Jul 86
pp 644-649

[English abstract of article by Qian Qiuming [6929 4428 2494], et al., of Shanghai Institute of Optics and Fine Mechanics, Academia Sinica]

[Text] The reflection wave of a cone beam, which is formed by a linearly polarized plane wave through a convergence system and then incident upon a stratified medium, is analyzed. The reflection phase shift in the whole aperture and the dispersion are figured out by using the expression of the electric field strength which is derived in the paper. Furthermore, aberrations can be discussed while the multilayer thin film is regarded as an element of an imaging system.

In addition, an expression of the intensity distribution of the interference field produced by two reflection waves with the initial waves of SM (the electric vector is perpendicular to the plane of main ray incidence) and PM (the electric vector is parallel to the plane of main ray incidence), is deduced. Specially applied to a multilayer composed of seventy-one layers, the numerical calculation conforms to experimental results quite well. (Paper received 22 Oct 85.)

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CSO: 4009/110

Petrochemicals

MATHEMATICAL MODEL FOR HEAVY OIL CRACKING--PROCESS CALCULATION MODEL FOR RADIANT SECTION TUBES IN CRACKING FURNACE

Beijing SHIYOU HUAGONG [PETROCHEMICAL TECHNOLOGY] in Chinese Vol 15 No 1, Jan 86 pp 1-9

[English abstract of article by Huang Wen [7806 2429], et al., of China Huanqin Chemical Engineering Corporation; and Yang Yuanyi [2799 0337 0001], et al., of Beijing Research Institute of Chemical Industry]

[Text] This paper is the second part of an article on mathematical modeling of a cracking furnace tube. The process-calculation model is based on the correlation of product distribution with the cracking severity function $k\theta$ and hydrocarbon partial pressure, with due consideration taken of heat, mass and momentum balance within the furnace tube. According to different raw materials, the appropriate type of furnace can be selected, and the furnace tube size, operating parameters and product yields are calculated.

This model can also be used to select the proper process operating parameters and predicted yields when changing raw materials. (Paper received 13 February 1985.)

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INFLUENCE OF PRETREATMENT AND MODIFICATION WITH OXIDES ON ZSM-5 CATALYST FOR TOLUENE ETHYLATION

Beijing SHIYOU HUAGONG [PETROCHEMICAL TECHNOLOGY] in Chinese Vol 15 No 1,
Jan 86 pp 10-14

[English abstract of article by Dong Jialu [5516 1367 74583-6922], et al., of
the Department of Chemistry, Nanjing University]

[Text] The influence of pretreatment with steaming or coking and modification
with oxides on ZSM-5 zeolite catalyst for ethylation of toluene has been
studied. The increasing effect of pretreatment on the para-selectivity of
ethylation was steaming < coking < steaming + coking. As for modification
with oxides, the effect was $\text{MgO} < \text{Sb}_2\text{O}_5 < \text{P}_2\text{O}_5$, $\text{P}_2\text{O}_5\text{-MgO}$.

The conversion of toluene and *p*-selectivity over $\text{P}_2\text{O}_5\text{-MgO-ZSM-5}$ catalyst
(20 cc) was about 12.5 percent and 97 percent respectively. (Paper received
2 April 1985.)

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PREVENTION OF QUENCH-BOILER CORROSION

Beijing SHIYOU HUAGONG [PETROCHEMICAL TECHNOLOGY] in Chinese Vol 15 No 1,
Jan 86 pp 27-31

[English abstract of article by Wang Deying [3769 1795 5391], et al., of
the Research Institute of Metal Corrosion and Protection, Chinese Academy of
Sciences, Shenyang]

[Text] This paper investigates the prevention of corrosion in the quench
boiler. By improving boiler feed water treatment, enhancing deoxygenation
efficiency, implementing close automatic pH control and adopting better
drainage processes so as to avoid accumulation of impurities and formation
of precipitates, the international standards have been reached, with no
deposition on the lower pipe plate. Therefore, boiler corrosion can be
prevented without shutdown and the service life is extended, bringing about
remarkable economic benefits. (Paper received 4 March 1985.)

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