taneously. It is possible to assess in visual terms the differences in the lighting effects depending upon the performances in the lighting effects depending upon the performance of the lighting fixture (luminous intensity distribution characteristics).

However, when the system is used to evaluated how well the player can see the ball, its findings — such as those for images based on a calculation regarding direct light alone — are not appropriate since the lower part of the ball, which is not lighted, is not shown at all. The case needs synthesizing images which take into account the lighting reflected on the tennis court surface. True — to — life images can be obtained by this system with a higher accuracy.

(5) Experimental studies on predictions of illuminance on the working plane from horizontal and vertical louver-type sunshade systems

K. MATSUURA, KIM Hway Suh

The purpose of the paper is to investigate the already proposed calculation methods of Matsuura et al. for horizontal and vertical louver-type sunshade system with uniformly diffused flat slat by experimental studies on real blind system under natural luminous conditions.

Two 1:5 scale models of a uni-lateral side-lit square room, one finished in interior by a usual colored and the other by black surfaces are set up on the flat roof where there is no obstruction. The louver slats are uniformly illuminated by the sunlight and precisely shaded it. Then the total and direct illuminance values are simultaneously measured in the usual colored and black rooms and then the indirect components can be obtained from the difference between the measured values in these two rooms.

From the measurements of direct illuminances by the Venetian blind system it is clear that the measured values depend only on the profile angle of the sunlight with no relation to the azimuth of the sunlight. The measured results of total and direct illuminances on the working planes agree approximately with the calculated values in the usual colored and black surface models respectively. In case of the vertical louver blind system the measured total and direct illuminances also agree with the calculated values regardless of the altitude and azimuth of the sun.

It is concluded by these experiments that our proposed calculation method of the louver blind system with uniformly diffused flat slats is able to predict the illuminances by the Venetian blind system and also by the vertical louver blind system.

(6) Visual fatigue induced by the character contrast and color on the CRT display screen

H. NAGAI, M. SHIMA, R. ITATANI

With the increasing computerization of offices the complaints of people working with VDUs are growing. For that reason the VDU manufacturers and ergonomic scientists are looking for ways to reduce the negative aspects of working with VDUs by improving the screens.

In this paper, we investigated the relation between character contrast and color on the CRT display screen and visual fatigue.

The room chosen for the experiment was 2.5m by 3.3m by 2.8m high. The space for the visual task performance was illuminated by a surface mounted luminaire and two suspended luminaries. The horizontal illuminance were 500 1x and 700 1x on the surface of the key board. The vertical illuminance was 300 1x on the screen surface of the CRT display.

For the experimental apparatus, we set up on the desk a NEC personal computer (PC-9801Vm), NEC 14 inch color character display (PC-8853n) with a filter, keyboard and thermal printer.

The character colors adopted were white, green, yellow and light blue by the color character display, in addition, a screen with dark characters on bright background. The contrasts of the screen were 5.0, 10, 15 and 20 in the ratio of character luminance to background luminance.

The visual performance was to simulate frequent changes of view. It consisted of comparing, word-for-word (312 words), random combinations of letters 00, 08, 0B, 80, 88, 8B, BO, B8 and BB with the upper and lower sides on the screen.

In this study, five volunteers were tested. The visual task time for subjects was limited to 30 minutes. The degree of visual fatigue was estimated with the fluctuation rate of the accommodation time of the eye during the visual task performance. Also, we measured the critical fusion frequency, the working hours to check on the words, error and subjective evaluation.

The results shows that the visual fatigue is more remarkable for green characters and the lower contrasts of the bright background display.

(7) Monte Carlo simulation of illuminance distribution and interreflection in cubic interior with visual obstructions

M. NAGATA

This study aims to calculate the illuminance distribution on all wall surfaces, and to discuss the validity of the conservation law of photon bundles caused by its interreflection between the wall surfaces in the cubic interior with three visual obstructions, by means of Monte Carlo simulation (MCS). MCS in lighting calculation has a large advantage due to the wide applicability without any limitations for the complicated lighting systems in practical use.

As a result, direct illuminance distributions calculated by MCS on all wall surfaces, including both sides of visual obstructions, coincide fairly well with those based on the inverse-square and cosine law. As for the conservation law of photon bundles caused by its interreflection between the wall surfaces, it is exactly confirmed by means of MCS that the well known equation (1) for the multiplication ratio of luminous flux in the globe photometry is also evidently kept between total incident photon bundles F_i upon all wall surfaces with reflectance p and those F_o emitted from the light source in this interior.

$$F_i \, / \, F_o \, = \, 1 \, / \, (1\text{-}p) \quad \ldots \ldots \quad (1)$$

(8) Mean skies in China

H. NAKAMURA, M. OKI, T. OTSURU, I. KIMURA, K. SHIBATA

CIE technical committee TC-309 was organized in 1983 to establish a new reference sky for daylight prediction. The draft of report has been finished and is being edited to be a new CIE Technical Report. TC-309, however, could not recommend a new reference sky in the draft. It instead listed various research works on daylight and sky luminance distribution and only *introduced* this Mean Sky which the chairman of TC-309 had intended to *recommend* as a new CIE Standard Sky.

The Mean Sky is an average luminance distribution of skies which appear at reference points during the total working hours of a specified period with a fixed daily working time. It can be calculated for any point in the world for the application to daylight prediction.

The Procedure for calculation of the Mean Sky explained in the draft was modified a little by the chairman (from that originally proposed by the authors) in order to calculate the Average Skies. But this modification contained a fault due to an improper assumption that the frequency of occurrence of solar position in the sky vault was even.

In this paper two procedures, that is by the original method of the authors and that modified by the chairman of TC-309, are explained. Also, the two kinds of Mean Skies at a number of cities in