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NASA TECH BRIEF

Manned Spacecraft Center

Kaleidoscopic Light Feedback for Television Systems

A newly developed kaleidoscopic light-feedback technique generates special effects for broadcast television and can be used in studying the effects of light feedback on television systems. With this device, television signals are produced for tape recording, broadcasting, or displaying on black-and-white or color monitors. The patterns produced have from three to eight sides. They expand, contract, or rotate at various speeds in either direction and change shape continuously. Prior techniques, using either computers or photography, were slower and more expensive and required more equipment.

The zoom lens of a television camera is focused on a television monitor, with the video output of the camera fed into the monitor. The width of the lens view angle is adjusted so that the multiple images displayed on the monitor converge. Adjusting the *f*-stop then produces a white image on the monitor. The image consists of vertical bars that appear to rush toward the viewer. Rotating the camera to tilt its scanning raster relative to the monitor's raster produces the kaleidoscopic effect.

The number of sides in the pattern is directly proportional to the angle, according to the following:

$$X = \frac{2\pi}{\theta}$$

where X = # of sides

θ = angle, in radians

The camera picks up light from the monitor and redisplays it on the monitor. This monitor light reinforcement creates a white spot (or spots) on the monitor. With the camera tilted, the spot is displayed at a different place on the monitor whenever the camera produces a picture. Thus, the spot is reproduced in four positions for a camera angle of $\frac{\pi}{2}$ rad., and slight deviation from $\frac{\pi}{2}$ rad. causes the pattern to rotate.

Moving the camera toward the monitor causes the pattern to continuously expand because each successive image played back is progressively magnified. Moving the camera backward causes pattern contraction because of similar demagnification of the image. The image shape changes constantly because the camera's image sensor is less sensitive to light in areas recently exposed to light than in unexposed areas; thus, the image continuously shifts to more sensitive areas. In some instances, this shifting produces either two directions of rotation in the same image or different speeds of rotation. Several alternative forms of the device are possible. For instance, the patterns appear to be most intricate when a camera having a minimum of shading (nonuniform response to light in different areas of the picture) is used with a color television monitor. The dot structure of the color picture tube tends to break up the spots and create more intricate patterns.

Other possible variations include using a stroboscopic light flashed on the monitor, using an NTSC color encoder, adjusting the color on a color monitor, aiming color cameras at color monitors, modulating the voltage of the camera's sensor or the monitor, and applying audio voltages to the video. Other television pictures can be mixed with the patterns either on the feedback monitor or for distribution to other monitors.

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Code BM7
Manned Spacecraft Center
Houston, Texas 77058
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Patent status:

No patent action is contemplated by NASA.

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