

## Highly Functional Surround Sound Mixer -For easier production of 5.1 surround sound-

One of the attractions of digital broadcasting is the 5.1 channel surround sound currently being offered for movies and music concerts. Popularization of 5.1 channel surround will require us to make available more slots for these types of programming. For this reason, research is underway to construct a special mixing console that can easily create surround sound effects, such as the sensations of sound movement and envelopment.

Surround sound effects can be categorized into four types, as shown in Figure 1. The production of such sound effects using the present mixing table involves great effort and a lot of time. For instance, the adjustment of the perceived sound distance requires simultaneous control of the sound volume, equalization, and reverberation. However, the fact

that all the surround sound effects are produced through a combination of distances and directions is considered to be the key to simpler sound effects productions. A mixing console should have controls for adjusting a sound's distance and direction.

In line with this idea, we constructed an automated sound mixer equipped with a distance fader and a sound image direction control circuit (Figure 2).

### ●Distance Fader

The perceived distance to a sound source is determined by three factors: loudness, tone color, and reverberation. The distance fader adjusts the attenuation of a direct sound attenuator, simulating the attenuation of sound outdoors with distance. The filter characteristics are also adjusted, simulating atmospheric absorption of sound related to tone color, synchronized with the reverberation control. This provides natural sounding changes in the perceived distance of the sound.



Setsu KOMIYAMA,  
Senior Research  
Engineer, Visual  
Information  
Technology

### ●Sound Image Direction Control Circuit

The ordinary circuit to control sound direction changes the proportion of the five output levels; it has the drawback that the perceived sound between the front and rear loudspeakers is not smoothly continuous. The developed sound image direction control circuit moves the sound image, by assuming the use of eight-channel loudspeakers, which consist of 5 channels with virtual side and back loudspeakers added. The actual 5.1 channel surround sound is generated by down mixing this eight-channel sound by using a head-related transfer function. This greatly improves the sound continuity between the front and rear loudspeakers.

### ●Automation

Using the editing screen shown in Figure 3, even a complex sound image movement can be reproduced at an arbitrary speed with a single operation. This is done through editing of the temporal changes in the distance and direction of sounds.

This surround mixer, with its capacity to control a sound's perceived distance and direction, has proved its effectiveness in actual applications, such as FM radio audio dramas and TV music programs.

Future work will involve verifying the mixer's operability for surround sound effects, with the aim of eventually creating an easy-to-use production tool 5.1 for generating surround-sound.

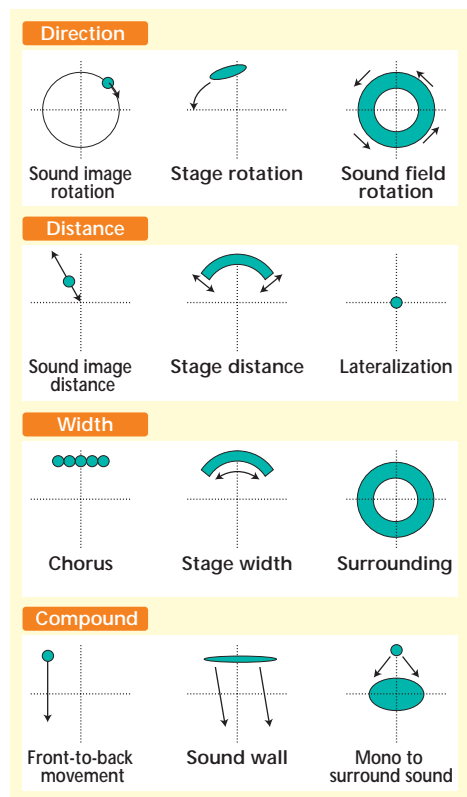


Figure 1: Surround sound effect to be required in 5.1 channel program production



Figure 2: Operating device for the prototype surround mixer



Figure 3: Editing screen for temporally changing sound distance and direction