Full-viewing or Underwater Arc 3D display and Arial-image DFD display for VR biology

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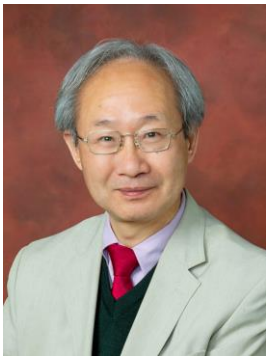
We want to develop “aquatic display” that does not interfere with the flow of water or the movement of fish by utilizing the aerial display that forms images in mid-air in Grant-in-Aid for Scientific Research (S). By using this “aquatic display”, a new biological experiment method using VR biology and monitoring the breeding status of fish in aquaculture without stressing the fish will be achieved. For developing “aquatic display”, we have proposed 3D displays for candidates, such as (A) Full-viewing Arc 3D display, (B) Underwater Arc 3D display and (C) DFD display with aerial image. (A) Full-viewing Arc 3D display can be simply constructed by using circular-shaped scratches and illumination perpendicular to scratches. Bright spot positions to each eye autonomously change according to the eye movement. This leads to binocular disparity to both eyes, and autonomous change according to eye movement results in continuous motion parallax. Moreover, circular symmetry structure provides full-viewing 3D images with small blind positions. (B) Underwater Arc 3D display has a problem of small difference of refractive index between substrate material (~1.5) and water (~1.3) as compared to air (1.0) because Arc 3D image is caused by refracted or reflected light in the scratches. However, even in water, Arc 3D images can be observed and bright spot position change by observation point is the same as in air. Moreover, higher brightness is obtained by using comparatively hard substrate and increasing scratching strength. (C) Aerial-image DFD display is composed of conventional LCD and aerial image. Perceived depth of aerial-image DFD display is almost linearly changed by luminance ratio between front and rear image as same as one of conventional DFD display.

Short biography:



Shiro Suyama received the M.E. degrees from Kyushu University in 1981. Since joining NTT Electrical Communication Laboratories in 1981, he has been engaged in research and development on transistor and liquid-crystal devices. He received the PhD degree from Kyushu University in 1990. He was a Professor at Tokushima University from April 2007 to March 2021 and is currently a Project Professor at Utsunomiya University from April 2021. He is engaged in research on 3D display systems; e.g. DFD (Depth-fused 3-D) display, Arc 3D display, Aerial display, Enhancing image reconstruction in Brain, Three-dimensional perceptions and Liquid-crystal varifocal lens.