CLAIMS

1. A device for rendering a higher order ambisonic (HOA) audio signal, the device comprising:

a memory configured to store field of view (FOV) parameter information and HOA audio data associated with an HOA audio signal; and

one or more processors coupled to the memory, the one or more processors being configured to:

modify a rendering matrix based on one or more FOV parameters of a reference screen and one or more FOV parameters of a viewing window to form a modified rendering matrix; and

apply the modified rendering matrix to at least a portion of the stored HOA audio data to render the HOA audio signal into one or more speaker feeds.

2. The device of claim 1, wherein the one or more processors are further configured to:

determine a renderer for the HOA audio data; and

modify the renderer based on the one or more FOV parameters of the viewing window and the one or more FOV parameters of the reference screen.

3. The device of claim 2, wherein to determine the renderer for the HOA audio data, the one or more processors are further configured to determine the renderer based on a speaker configuration associated with the one or more speaker feeds.

4. The device of claim **2**, wherein the renderer comprises one or more of a rendering format or an algorithm for converting the HOA audio data to a reproduction format.

5. The device of claim **2**, wherein to modify the renderer, the one or more processors are further configured to:

based on the one or more FOV parameters of the reference screen and the one or more FOV parameters of the viewing window, determine an angle mapping function for modifying speaker angle information; and

based on the angle mapping function, modify an angle for a speaker associated with the one or more speaker feeds to generate a modified angle for the speaker.

6. The device of claim **2**,

wherein the one or more processors are further configured to determine, in response to detecting a user initiated zoom function, determine one or more FOV parameters of a zoomed viewing window, and

wherein to modify the renderer, the one or more processors are further configured to modify the renderer based on the one or more FOV parameters of the zoomed viewing window.

7. The device of claim **6**, wherein to modify the renderer, the one or more processors are further configured to:

obtain a scaling factor in response to detecting a user initiated zoom operation;

based on the scaling factor and the one or more FOV parameters of the viewing window, determine one or more FOV parameters of a zoomed viewing window;

based on the one or more FOV parameters of the zoomed viewing window and the one or more FOV parameters of the reference screen, determine an angle mapping function for modifying speaker angle information; and

based on the angle mapping function, modify an angle associated with a first speaker of the one or more speakers to generate a modified angle for the speaker.

8. The device of claim **7**, wherein to determine the one or more FOV parameters of the zoomed viewing window, the one or more processors are further configured to determine one or more azimuth angles for the zoomed viewing window based on one or more azimuth angles for the viewing window and the scaling factor, and to determine the one or more FOV parameters of the zoomed viewing window, the one or more processors are further configured to determine one or more elevation angles for the zoomed viewing window based on one or more elevation angles for the viewing window and the scaling factor.

9. The device of claim **1**, wherein the one or more FOV parameters for the reference screen comprise at least one of one or more azimuth angles for the reference screen or one or more elevation angles for the reference screen.

10. The device of claim **1**, wherein the one or more FOV parameters for the viewing window comprise at least one of one or more azimuth angles for the viewing window or one or more elevation angles for the viewing window.

11. The device of claim **1**, wherein the one or more processors are further configured to render the HOA audio signal into the one or more speaker feeds based on a scaling factor obtained in response to detecting a user initiated zoom operation.

12. The device of claim **1**, wherein the one or more FOV parameters for the reference screen comprise coordinates of a center of the reference screen and coordinates of a center of the viewing window.

13. The device of claim **12**, wherein the one or more processors are further configured to:

determine the coordinates of the center of the reference screen based on the one or more FOV parameters of the reference screen; and

determine the coordinates of the center of the viewing window based on the one or more FOV parameters of the viewing window.

14. The device of claim **12**, wherein the one or more processors are further configured to:

determine a renderer for the HOA audio data; and

modify the renderer based on the coordinates of the center of the viewing window and the coordinates of the center of the reference screen.

15. The device of claim **12**, wherein the one or more processors are further configured to:

rotate a soundfield described by the HOA audio signal from the center of the reference screen to the center of the viewing window.

16. The device of claim **1**, wherein the HOA audio signal comprises an MPEG-H 3D compliant bitstream.

17. The device of claim **1**, wherein the one or more processors are further configured receive a syntax element that indicates whether rendering of the HOA audio signal based on the one or more FOV parameters of the reference screen and the one or more FOV parameters of the viewing window is enabled.

18. The device of claim **1**, wherein the device further comprises at least one speaker associated with the one or more speaker feeds, and wherein to render the HOA audio signal, the one or more processors are further configured to generate a loudspeaker feed to drive the at least one speaker.

19. The device of claim **1**, wherein the device further comprises a display for displaying the viewing window.

20. The device of claim **1**, wherein the one or more processors are further configured to decode the HOA audio signal to determine a plurality of HOA coefficients.

21. The device of claim **20**, wherein the one or more processors are further configured to:

generate a mode matrix for nine-hundred sampling points of a sphere;

modify the mode matrix based on the one or more FOV parameters of the reference screen and the one or more FOV parameters of the viewing window to generate an effect matrix; and

render the HOA coefficients based on the effect matrix.

22. The device of claim **1**,

wherein the stored HOA audio data includes one or more foreground audio objects,

wherein the one or more processors are further configured to reconstruct the stored HOA audio data based on the one or more foreground audio objects, and

wherein the rendered HOA audio signal comprises HOA coefficients representative of the reconstructed one or more foreground audio objects.

23. A method of rendering a higher order ambisonic (HOA) audio signal, the method comprising:

modifying a rendering matrix based on one or more field of view (FOV) parameters of a reference screen and one or more FOV parameters of a viewing window to form a modified rendering matrix; and

applying the modified rendering matrix to at least a portion of the HOA audio signal to render the HOA audio signal into one or more speaker feeds.

24. The method of claim **23**, further comprising

receiving a bitstream of encoded audio data comprising the HOA audio signal, wherein the encoded audio data is associated with corresponding video data;

obtaining from the bitstream the one or more FOV parameters of the reference screen for the corresponding video data; and

obtaining the one or more FOV parameters of the viewing window for displaying the corresponding video data.

25. The method of claim **23**, further comprising:

determining a renderer for the HOA audio signal; and

modifying the renderer based on the one or more FOV parameters of the viewing window and the one or more FOV parameters of the reference screen.

26. The method of claim **25**, wherein determining the renderer for the HOA audio signal comprises determining the renderer based on a speaker configuration of the one or more speaker feeds.

27. The method of claim **26**, wherein the one or more FOV parameters for the reference screen comprise at least one of one or more azimuth angles for the reference screen or one or more elevation angles for the reference screen.

28. The method of claim **23**, further comprising:

decoding the HOA audio signal to determine a plurality of HOA coefficients; and

rendering the HOA coefficients.

29. The method of claim **23**, wherein the HOA audio signal includes a predominant audio signal, the method further comprising reconstructing the HOA audio signal based on the predominant audio signal, wherein the rendered HOA audio signal comprises HOA coefficients representative of the reconstructed predominant audio signal.

30. An apparatus for rendering a higher order ambisonic (HOA) audio signal, the apparatus comprising:

means for receiving the HOA audio signal; and

means for modifying a rendering matrix based on one or more field of view (FOV) parameters of a reference screen and one or more FOV parameters of a viewing window to form a modified rendering matrix; and

means for applying the modified rendering matrix to at least a portion of the HOA audio signal to render the HOA audio signal into one or more speaker feeds.

31. The apparatus of claim **30**, further comprising:

means for receiving a bitstream of encoded audio data comprising the HOA audio signal, wherein the encoded audio data is associated with corresponding video data;

means for obtaining from the bitstream the one or more FOV parameters of the reference screen for the corresponding video data;

means for obtaining the one or more FOV parameters of the viewing window for displaying the corresponding video data.

32. A non-transitory computer-readable storage medium storing instructions that when executed by one or more processors of a device for rendering a higher order ambisonic (HOA) audio signal, cause the one or more processors to:

modify a rendering matrix based on one or more field of view (FOV) parameters of a reference screen and one or more FOV parameters of a viewing window to form a modified rendering matrix; and

apply the modified rendering matrix to at least a portion of the HOA audio signal to render the HOA audio signal into one or more speaker feeds.