Claims

1. A method of creating haptic feedback using ultrasound comprising the steps of:

generating a plurality of ultrasound waves with a common focal point using a phased array of ultrasound transducers, the common focal point being a haptic feedback point; and

modulating the generation of the ultrasound waves using a waveform selected to produce little audible sound at the haptic feedback point.

2. The method as in claim 1 further comprising the step of avoiding sharp pressure changes at the focal point.

3. The method as claim 2 further comprising the step of modulating the generation of the ultrasound waves with a waveform comprising an interpolation of the transducer phases and amplitudes.

4. The method as claim 3, wherein the interpolation is a linear interpolation.

5. The method as in claim 3, wherein the interpolation is selected from the group consisting of a polynomial interpolation and a trigonometric interpolation.

6. The method as in claim 3, wherein the interpolation is a cosine interpolation.

7. The method as in claim 3, wherein the interpolation is a parametric speaker interpolation.

8. The method as in claim 1 further comprising the step of varying the position of the common focal point.

9. The method as in claim 8, wherein the position of the common focal point is constantly varied.

10. The method as in claim 8, wherein the position of the common focal point oscillates about a central focal point.

11. A haptic feedback system comprising:

a phased array comprising a plurality of transducers arranged to emit ultrasound to create a haptic feedback point, the phased array arranged to emit ultrasound according to a modulation waveform having a shape that produces little or no sound when the ultrasound converges at the haptic feedback point.

12. The haptic feedback system as in claim 11 further comprising a control unit.

13. The haptic feedback system as in claim 11 further comprising a driving unit.

14. The haptic feedback system as in claim 13, wherein the driving unit is arranged to drive the transducer to produce ultrasound.

15. The haptic feedback system as in claim 14 further comprising a control unit arranged to send control signals to the driving unit.

16. The haptic feedback system as in claim 12, wherein the control unit includes a memory.

17. The haptic feedback system as in claim 12, wherein the control unit is arranged to modulate the output of the transducer according to a particular modulation waveform.

18. The haptic feedback system as in claim 17, wherein the modulation waveform is a linear interpolation.

19. The haptic feedback system as in claim 17, wherein the modulation waveform is an interpolation selected from the group consisting of a polynomial interpolation and a trigonometric interpolation.

20. The haptic feedback system as in claim 17, wherein the modulation waveform is a cosine interpolation.

21. The haptic feedback system as in claim 17, wherein the modulation waveform corresponds to a parabolic speaker interpolation.