distal face of the stabilizer blade has an inset transmitter 142 separated from an array of inset receivers 146 by an acoustic isolation zone. The acoustic isolation zone is designed to attenuate and delay acoustic wave energy propagating via through the tool body from the transmitter to the receivers. To that end, the acoustic isolation zone can include voids or inserts 144 that provide an arrangement of acoustic contrasts to reflect and attenuate acoustic wave energy. Inserts 144 can be made of a resilient material (e.g., vulcanized rubber) that efficiently dissipates acoustic wave energy as heat, thereby providing further attenuation. Careful design of the void shapes can create a series of acoustic propagation paths that cause destructive interference at the receivers over a desired frequency band. By reducing and delaying the acoustic wave energy that reaches the receivers through the tool body, the acoustic isolation zone improves the sensitivity of the receivers to the acoustic wave energy 152 propagating through the borehole wall.

In some embodiments, the acoustic transmitters are electrical transducers made of a piezoelectric material, enabling the tool to generate programmable acoustic signals. Alternatively, bender bars or other acoustic transducers can be used. The receivers can be electrical transducers made of a piezoelectric material. In some embodiments, the transmitter and receiver transducers are flush with the surface of a wall-contacting face to minimize standoff, while in other embodiments the transducers are slightly inset, covered with a protective layer, and/or set in a protrusion face that is kept at a small standoff from the borehole wall to prevent undue erosion of the transducers. In some embodiments, the transducers are inset by approximately 1/8 inch (0.32 cm), or possibly up to about 1/4 inch (0.64 cm), and the total inset area surrounding the transducer is no more than 10 times the sensing area of the transducer itself. In other embodiments, the distal face of the protrusion is kept at a small standoff (e.g., about 1/10 of an inch (0.25 cm)) as the tool rotates within the borehole. This configuration could be achieved using a set of stabilizers on either side of the tool, with a slightly larger outer diameter than the circle traced by the distal face of the tool protrusion(s). Some designs angle the transmitter and receiver transducers towards each other to increase the signal strength.

8. The tool of claim 5, further comprising a second acoustic receiver set in said face, wherein the processing circuitry measures said velocities or slowness values based at least in part on signals from both receivers.

9. The tool of claim 8, further comprising a second acoustic transmitter set in said face, wherein the processing circuitry measures said velocities or slowness values based at least in part on signals from both receivers in response to each transmitter.

10. The tool of claim 9, wherein the receivers are on a line between the transmitters and spaced equally from a midpoint between the transmitters.

11. The tool of claim 8, wherein the second receiver is less than 2 inches (5.08 cm) from the first receiver and less than 20 inches (50.8 cm) from the transmitter.

12. The tool of claim 1, further comprising a telemetry module that communicates formation density information uphole.

13. A logging method that comprises:

rotating a logging-while-drilling tool as it moves along a borehole;

detecting acoustic waves propagating along a wall of the borehole using at least two receivers;

processing signals from the receivers to measure formation density values; and

associating the formation density values with the tool's position and orientation.

14. The method of claim 13, further comprising displaying a borehole wall image calculated based at least in part on the formation density values.

15. The method of claim 13, wherein the processing includes measuring P-wave and S-wave slowness values and determining said formation densities based at least in part on the P-wave and S-wave slowness values.

16. The method of claim 13, wherein the receivers are set in a distal face of a protrusion on the tool.

17. The method of claim 16, further comprising: generating acoustic waves using a transmitter on the distal face, said distal face being on a stabilizer blade attached to the tool.

18. The method of claim 17, further comprising:

generating acoustic waves using a second transmitter on the distal face of said stabilizer blade, wherein the receivers are on a line between the transmitters and spaced equally from a midpoint between the transmitters.

19. The method of claim 17, wherein the receivers are less than 2 inches (5.08 cm) apart and are no more than 20 inches (50.8 cm) from the transmitter.

20. The method of claim 13, further comprising transmitting waveforms via wired drillpipe to the surface for processing.

21. The method of claim 16, wherein the distal face remains within 0.3 inches (0.76 cm) of the borehole wall as the tool rotates.

22. The method of claim 13, wherein said processing signals from the receivers to measure formation density includes using a fluid cell to measure acoustic impedance of fluid in the borehole.