Mathematicians find way to improve medical scans

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Mathematicians at the University of Liverpool have found that it is possible to gain full control of sound waves which could lead to improved medical scans, for technology such as ultra sound machines.

Working in partnership with the Indian Institute of Technology in Kanpur, they tested the numerical properties of a flat lens made out of ‘meta-material’ - a material that gains its properties from its structure rather than its composition. This material is thought to defy the laws of physics, allowing objects to appear exactly as they are rather than upside down as seen in a normal convex or concave lens.

Dr Sebastien Guenneau, from Liverpool’s Department of Mathematical Sciences, explains: “We know that light can be controlled using ‘meta-material’ which can bend electromagnetic radiation around an area of space, making any object within it appear invisible. Now we have produced a mathematical model that proves this theory also works for sound.

“This theory becomes particularly interesting when considering ultrasound, which is a sound pressure used to penetrate an object to help produce an image of what the object looks like inside. This is most commonly used in pregnancy scans to produce an image of a foetus. We found that at a particular wave frequency the meta-material has a negative refraction effect, which means that the image produced in the flat lens appears at a high resolution in exactly the same way it appears in reality.

“What surprised us most of all, however, was at the point where negative refraction occurs the meta-material becomes invisible, suggesting that if we were to use this in sonogram technology, it could be possible to make the image appear in mid-air like a hologram rather than on a computer screen. We also found that if we arranged the meta-material in a checkerboard fashion, sound became trapped, making noisy machines, for example, quieter.”

The scientists predict that the technology could be adapted for tests at higher sound frequencies such as when drilling for oil, where a more accurate image of the earth could be made in order to pin point where drilling should take place.

Source: University of Liverpool

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