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Enabling next-generation wireless implant transmission FREE

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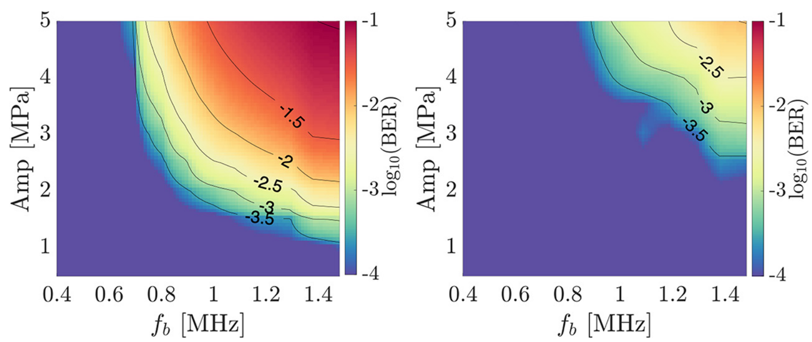
Next-generation medical implants will need to account for the nonlinear propagation of acoustic signals through biological tissue, which impairs wireless transmission.



Existing wireless medical implants have limited data rates mostly because they use radio waves to send and receive signals, which are hampered by transmission through biological tissue. Acoustic waves, on the other hand, do not have this limitation, meaning next-generation wireless medical implants could improve their communication by using ultrasound.

Though previous work in the field has sent acoustic waves through tissues using methods developed for linear systems, the propagation of acoustic waves in biological tissues exhibits significant nonlinearity. This is known to distort transmission, but the specific effects on performance have not been examined. Tabak et al. studied how wireless transmission through different tissues of the body affects acoustic signals with varying properties.

Many wireless communication applications achieve faster and more reliable data transmission by increasing a signal's amplitude and bandwidth. However, the authors' simulations showed that as amplitude and bandwidth increased, errors and distortion did as well. These worsened in tissues that exhibit more nonlinearity, such as fat.

"These findings suggest that relying on conventional methods to speed up transmission rates

and improve performance might result in worse outcomes if the effects of nonlinearity are not compensated," said author Gizem Tabak. "These factors might need to be taken into consideration, especially when building data-hungry transmission applications such as data-streaming, smart biomedical implants."

The authors carried out their simulations in simple, homogenous tissues. Next, they hope to extend this work to experimental setups as well as more complex tissues to test its applicability with real medical implants.

Source: "Effects of acoustic nonlinearity on communication performance in soft tissues," by Gizem Tabak, Michael L. Oelze, and Andrew C. Singer, *Journal of the Acoustical Society of America* (2022). The article can be accessed at https://doi.org/10.1121/10.0015402.

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