Wideband Data Transmission Using Pulse Harmonic Modulation (#5016)

A modulation technique, called Pulse Harmonic Modulation (PHM), enabling wideband, low power data transmission across inductive telemetry links that operate in the near-field domain

Maysam Ghovanloo and Farzad Inanlou from the School of Electrical and Computer Engineering at Georgia Tech developed a modulation technique, called Pulse Harmonic Modulation (PHM), enabling wideband, low power data transmission across inductive telemetry links that operate in the near-field domain. By using sharp and narrow pulses, similar to impulse-radio ultra wideband (IR-UWB) in the far-field, significant reduction in the transmitter power consumption can be achieved. This method helps to achieve a high data rate without reducing inductive link quality factor and selectivity while enhancing the ability to block interferers.

The received signal consists of an oscillation pattern that is modulated by the amplitude and timing of the pulses. These pulses facilitate data demodulation with low BER.

The PHM technique uses a pattern of sharp pulses with specific time delays and amplitudes that minimize the inter-symbol interference by amplitude modulating the received pulse harmonics. PHM does not require the coils to have characteristics such as low-Q (Quality Factor) and high SRF (self-resonance frequencies), which are not desired in the IMDs because they tend to lower the selectivity of the inductive link and signal-noise ratio at the receiver and impose size constraints due to large parasitic components.

Benefits/Advantages

- Allows for a high data rate, low power consumption and low interference when used in different applications such as IMD
- Improves the bandwidth and robustness of short-range wireless inductive links formed across the skin to send the necessary data from external sensor to implanted micro-simulators
- Applicable in proximity communications such as sensors and RFID device to transfer data rapidly over short distances like 1 inch

Potential Commercial Applications

The main application of the PHM is in neuroprostheses, such as invasive brain-computer interfaces or cochlear/retinal implants, which need to transfer large volumes of data across the skin. It may also be used in short range proximity-based digital communications with high throughput wireless devices. Other examples of near-field data transmission are radio-frequency identification (RFID), contactless smartcards,

and high throughput wireless sensors.

Futuristic Applications:

Imagine: watching your own content but on the built-in treadmill display simply by resting your phone on a pad across the treadmill front panel without needing to plug anything in while your phone is also being wirelessly charged. Or imagine you lay your phone down on a table at Starbucks, the surface of which is a large display. Simply by laying your phone down, your video content gets mirrored onto that larger table display while your phone is also being charged. PHM enables high data rate wireless near field communication that could be used for plug-less contact based HD video streaming, among other high-data-rate applications

Background/Context for This Invention

Short-range data and power transmission equipment use near-field inductive links for communication purposes. Implantable Medical Devices (IMD) also use an inductive link between two magnetically-coupled coils to wirelessly transmit power and data from outside to the inside. Reliable short-range wireless communication links for use in IMDs must overcome numerous challenges such as lower power efficiency, larger device sizes, narrower data transfer bandwidth and lack of robustness against external interference, i.e. low bit error- rate (BER).

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More Information

Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/wideband-data-transmission-using-pulse-harmonic-modulation

Images: