Tele-link for power supply

The battery may still get eliminated from lap-tops and cell phones, says S.Ananthanarayanan.

One great limitation of electronic devices is the need for a source of power. While the need to be connected, physically, has been removed in telecommunication with the use of ‘wireless’, even radio sets need electricity to run. And this has to come from a power socket or battery.

Wireless power?

Prof Marin Soljacic and colleagues at MIT seem to have found a way round, with power being transported by wireless, just like speech or data. This attractive possibility has not been realized so far because in radiative transmission, like with radio waves, the power transferred is very small, and the power actually received is a fraction of all the power transmitted. The great bulk of the power transmitted is just lost and wasted.

This works with data transfer because even feeble power transfer can enable capture of information, which can be amplified and made useful. The wasted part is not important because the total power used is small, and the system is one for transfer of data, not power.

In radiative systems, the loss is very fast as one gets further from the source – it is according to the inverse square law. At a distance of 100 metres, for instance, the signal is 10,000 times weaker than it was at 1 metre. And if that signal were received and used, 9,999 times the same signal has been wasted. If such a system was used to transfer power, we would need a very powerful source, with huge losses, to transfer even modest amounts of power.

Resonant systems

The situation gets dramatically altered if the receiving system is specially ‘tuned’ to receive power from the source. Then, we can arrange things so that the source is not ‘radiative’, but transmits freely when the receiver is ‘ready’, as if there were a ***pipeline*** from the source to the receiver.

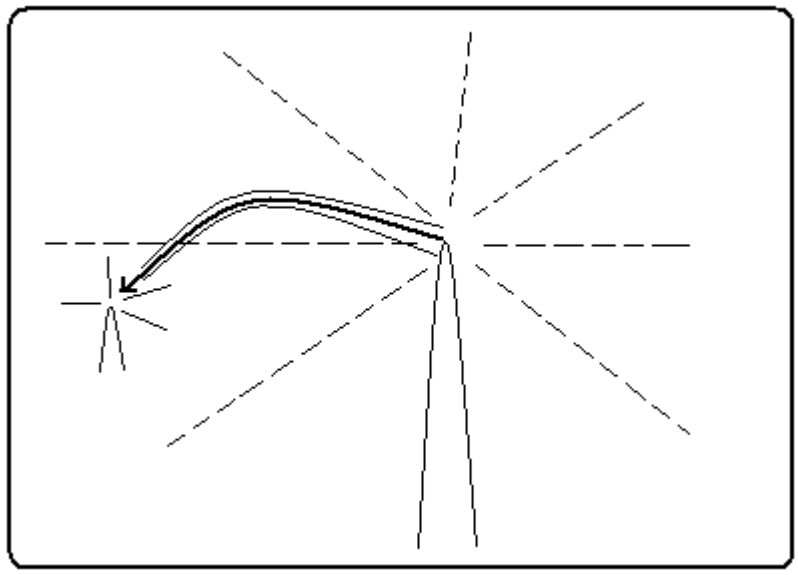
It is like the legendary case of a soprano giving vent in a studio full of wine glasses. If the glasses all had different levels of wine, so that only one glass would ring at just the pitch of the soprano, then, that glass would pick up the singer’s sound waves and vibrate so hard that it could shatter!

Now, a soprano is trained to sing to an auditorium and she is a ***radiative*** system by design. Hence, she doesn’t have to sing less energetically if no glass is tuned to her voice and there is no special draw on her strength if one glass is. It is different in the case of an

electric transformer, for instance. Here, there are 2 coils, one the source and the other the receiver. An iron core is passed through the coils, to improve the 'coupling' and reduce the effect of the distance separating them. This makes the receiver gather power readily. But still, if the 'receiver' coil, or the 'secondary', is not connected to some machine or other consumer of the power, it starts acting to block the 'primary', rather than draw power, and even the primary will consume almost 'no power'.

The MIT experiment

The MIT scientists set up a non-radiative source of a rapidly varying magnetic field, effectively a copper coil carrying a current alternating at millions of cycles a second. Such rapidly varying fields typically set up counter fields and not only do not radiate but even prevent currents themselves from flowing in the wires. This is the reason our TV cables need to be of special, 'shielded' kind.



So the rapidly alternating current in the coil was non-radiating, it just created a rapidly varying magnetic field in its vicinity. Now, if there were another coil in the vicinity, whose qualities were such that just this frequency would match its own natural frequency, then, this coil would start drawing energy from the 'primary' and soon build up a sizeable current in itself! This would be like a swing which begins to go real fast when the periodic up and down impulses of the child on the swing match its to and fro movement.

Based on this principle, the MIT scientists have been able to create a set-up that powers a 60 W bulb at a distance of 2 metres from the power source. This is a significant advance and may soon lead to ways to power a laptop PC without the need for a cable, or to charge mobile phones as they pass by power sources!