Wireless Power Transmission by Scalar Waves

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Abstract— Current RFID technology explains how the transfer of energy takes place on a chip card by means of longitudinal wave components in close range of the transmitting antenna. It is scalar waves which spread towards the electrical or the magnetic field pointer. That provides the better explanation. Using the wave equation proposed by Maxwell's field equations these wave components were set to zero. Why were only the postulated model computations provided after which the range is limited to the sixth part of the wavelength.

This text proposes instead the rationale for scalar wave components in the wave equation of Laplace. Physical conditions for the development of scalar wave transponders become operable well beyond the close range. Scalar wave information and energy is transferred with the same carrier wave and not carried over two separated ways as with RFID systems. Bi-directional signal transmission with energy transfer in both directions is achieved when there is a resonant coupling between transmitter and receiver.

The first far range transponders developed on the basis of the extended field equations are already functional as prototypes, according to the US-Patent No. 787,412 of Nikola Tesla: Art of transmitting electrical energy through the natural medium [11], New York 1905.

1. INTRODUCTION

Transponders serve the transmission of energy, e.g., on a chip card in combination with a transmission of information. The range is with the presently marketable devices (RFID technology) less than one meter [2]. The energy receiver must be in close range of the transmitter. The far range transponders developed by the first transfer centre for scalar wave technology are able to transfer energy beyond close range (10 to 100 m) with fewer losses and/or a higher efficiency. The energy using the same carrier wave is transferred as well as information vs. the RFID technology which uses two separate systems [2].

A condition for new technologies is a technical-physical understanding, as well as a mathematically correct and comprehensive field description, which include all well known effects of the close range of an antenna. We encounter here a central problem of the field theory, which forms the emphasis of this paper and the basis for advancements in transponder technology.

In today's times of bluetooth and Wireless LAN one quickly becomes accustomed to the amenities of wireless communication. For example garage gates, the barrier of the parking lot, or the car trunk are opened by radio.

However, the limited life span and often polluting batteries used in numerous radio transmitters and remote maintenances create a great disadvantage.

Ever more frequently the developers see themselves confronted with the demand for a wireless transfer of energy. Accumulators are to be reloaded or replaced completely. In entrance control systems (ski elevator, stages, department stores...) these systems are already successfully used. But new areas of application with increased requirements are constantly added apart from the desire for a larger range:

- In telemetry plants rotary sensors are to be supplied with energy (in the car, e.g., to control tire-pressure).
- Also with heat meters the energy should come from a central unit and be spreadly wireless in the whole house to the heating cost meters without the use of batteries.
- In airports contents of freight containers are to be seized, without having been opened (security checks).
- The forwarding trade wants to examine closed truck charges by transponder technology.
- In the robot and handling technique the wirings are to be replaced by a wireless technology due to wear-out problem.
- Portable radio devices, mobile phones, Notebooks and remote controls working without batteries and Accumulators will reduce the environmental impact.

A technical solution, which is based on pure experimenting and trying, is to be optimised unsatisfactorily and hardly. It should stand rather on a field-theoretically secured foundation, whereby everyone thinks first of Maxwell's field equations. Here however a new hurdle develops itself engaged closely.

2. FIELD THEORETICAL PROBLEM

In the close range of an antenna, the current level of knowledge is longitudinal based — towards a field pointer portions of the radiated waves present. These are usable in the transponder technology for the wireless transmission of energy. The range amounts to only $\lambda/2\pi$ and that is approximately the sixth part of the wavelength [6]. The problem consists now of the fact that the valid field theory from Maxwell, is only able to describe transversal and not longitudinal wave components. All computations of longitudinal waves or wave components, which run toward the electrical or the magnetic pointer of the field, are based without exception on postulates [12].

The near field is not considered in vain as an unresolved problem of the field theory. The experimental proof may succeed, but not the field-theoretical proof. The wave equation derived from the field equations according to Maxwell on one hand is a transverse electro-magnetic wave [10]:

$$\underbrace{-\text{curl curl}\,\mathbf{E}\cdot c^2}_{\text{transverse}} = \underbrace{\delta^2\mathbf{E}/\delta t^2}_{-\text{ wave}} \underbrace{+\,(1/\tau_1)\cdot\delta\mathbf{E}/\delta t}_{+\text{ vortex damping}} \tag{1}$$

On the other hand there is a damping term in the equation which is responsible for the losses of an antenna. It indicates the wave component, which is converted into standing waves, can also be called field vortices, which produce vortex losses for their part with the time constant τ_1 in the form of heat.

Where, at close range of an antenna proven and with transponders technically used longitudinal wave components hide themselves in the field Equation (1)?

3. WAVE EQUATION

The wave equation found in most textbooks has the form of an inhomogeneous Laplace equation. The famous French mathematician Laplace considerably earlier than Maxwell did find a comprehensive formulation of waves and formulated it mathematically:

$$\underbrace{\Delta\mathbf{E}\cdot c^2}_{\text{Laplace operator}} = \underbrace{-\text{curl curl}\,\mathbf{E}\cdot c^2 +}_{\text{transverse-(radio wave)}} \underbrace{\text{grad div}\,\mathbf{E}\cdot c^2 = \delta^2}_{\text{longitudinal-(scalar wave)}} \underbrace{\mathbf{E}/\delta t^2}_{\text{wave}} \tag{2}$$

On the one side of the wave equation the Laplace operator stands, which describes the spatial field distribution and, according to the rules of vector analysis, can be decomposed into two parts. On the other side the description of the time dependency of the wave can be found as an inhomogeneous term.

If the wave equation according to Laplace (2) is compared to Equation (1) derived from the Maxwell equations, then two differences clearly come forward:

1. In the Laplace equation the damping term is missing.
2. With divergence E a scalar factor appears in the wave equation and a scalar wave as a consequence.

A Practical example of a scalar wave is the plasma wave. This case forms according to the Maxwell Equation (3):

$$\text{div}\,\mathbf{D} = \varepsilon\cdot\text{div}\,\mathbf{E} = \rho_{el} \tag{3}$$

the space charge density consisting of charge carrier's ρ_{el} the scalar portion. These move in form of a shock wave longitudinal forward and present in its whole an electric current.

Since both descriptions of wave's posses equal validity, we are entitled in the sense of a coefficient comparison to equate the damping term due to eddy currents according to Maxwell (1) with the scalar wave term according to Laplace (2).

Physically seen the generated field vortices form and establish a scalar wave.

The presence of div $\mathbf{E}$ proves a necessary condition for the occurrence of eddy currents. Because of the well-known skin effect [3] expanding and damping acting eddy currents, which appear as a consequence of a current density $\mathbf{j}$, set ahead an electrical conductivity σ.

4. VIEW OF DUALITY

Within the near field range of an antenna opposite conditions are present. With bad conductivity in a general manner a vortex with dual characteristics would be demanded for the formation of longitudinal wave components. I want to call this contracting antivortex a potential vortex contrasting the expanding vortex by eddy currents.

If we examine the potential vortex with the Maxwell equations for validity and compatibility, then the potential vortex would be Zero. The derivation of the damped wave Equation (1), [7] can take place in stead of the electrical also for the magnetic field strength. Both wave Equations (1) and (2) do not change their shape. In the inhomogeneous Laplace equation in this dual case however, the longitudinal scalar wave component through $\operatorname{div}\mathbf{H}$ is described and this is according to Maxwell zero!

Maxwell's Equation (4):

$$\operatorname{div}\mathbf{B} = \mu \cdot \operatorname{div}\mathbf{H} = 0 \tag{4}$$

If this is correct, then there may not be a near field, no wireless transfer of energy, and finally also no transponder technology. Therefore, the correctness (of Equation (4)) is to be examined, what would be the result if potential vortices exist forming scalar waves in the air around an antenna, as the field vortices form among themselves a shock wave.

Besides still another boundary problem will be solved: since in div D electrical monopoles can be seen (3) there should result from duality magnetic monopoles to $\operatorname{div}\mathbf{B}$ (4). In October 2009 the search has been successful the first time [9]. Vortex physics will give the answer and the derivation in mathematic is still published [8]. What is the result?

5. TESLA'S DREAM, WIRELESS ENERGY SUPPLY

It is apparent from Tesla's patents that instead of using a connection line he grounded his pancake coils on one side. At the high voltages and frequencies he used the earth behave as part capacitive and part electrical conductor [11]. However with this technique any grounded consumer load in resonance can deduct energy. That might include a disagreeable competitor. That's why the project to wirelessly supply ships on the ocean with energy wasn't put into practice. However the feasibility of this principle was proven in 2001 by the "First Transfer Centre for Scalar Wave Technology" using a miniature boat.

"The boat is working without a battery", proclaims the narrator in a ZDF documentary. "*Also, it isn't dragging a cable along"*. The power output of its motor is approximately 5 Watts and the installation's efficiency is about 100%. As the electrical circuit closure is much easier to realize in practice than the magnetic one, at an unattainably high efficiency, especially the Tesla principle is considered economically viable.

In addition, metal parts are oftentimes present, functioning as potential equalization panel or return conductor, in a car for example the body, or the iron parts in a machine tool, the conduction system of heating pipes in consumption counters or the guiding rails in elevators or other rail-bound vehicles.

No one can ignore the fact that only in the case of resonance; energy will reach the receiver, i.e., at the same frequency and opposite sign. For the layman, that can be illustrated by the image of power "flowing out" of a power plant then "flowing in" to its consumer. Both leads in the cable thereby induce resonance as the two-poled plug is put into the socket.

In principle, this is also possible with only one cable, only then, the resonance is no longer forced, which is why the receiver can drop (i.e., energy does not reach it any longer). By optimising range and conservation of resonance, for example by variation of the coil and antennae geometry, these problems are manageable.

In wireless energy supplies as utilized in remote controls or mobile phones no "return conductor" is available. It is in these circumstances that magnetic coupling with all its disadvantages comes into play. The disadvantages culminate at the point where the receiver, entirely without guidance wires or other means of connection to the emitter, doesn't know which signal to resonate with. The limiting factor in practical use is not the distance over which resonance can still be maintained, but the tuning distance over which the wireless transmission system is capable of starting up without foreign assistance.

The tasks of a transponder include not only wireless energy, but also information transfer. Now both systems benefit from the fact that intertwined with the magnetic radiation field, magnetic scalar waves always appear, analogous to the electric ones accompanying electrical energy radiation.

To keep down transmission losses a minimization of scalar waves is the aim. In any case, the wave remainder is modulateable and usually sufficient for information conduction in both ways (i.e., from emitter to receiver and vice versa). That would be a ***point-to-point****-connection of energy and information*.

A ***multi-point****-connection* is set up so a power emitter supplies many stations with radiation energy, eliminated the need for a battery or external power supply. If a receiving station is being modulated (i.e., fed with information), this is noticeable at all other stations. Equipped with a code (i.e., with a pattern match comparable to a telephone number), individual communications within a vast network are also conceivable. That's the basis of a cell phone network relying on scalar waves, without radio masts, without harmful e-smog and with less that a thousandth of the emitting power common today.

6. SUMMARY, RFID TECHNOLOGY OR SCALAR WAVE TRANSPONDER?

In comparison, RFID technology (radio frequency identification) comes off badly, especially when both energy and bidirectional information transmission each rely on a separate system. While a scalar wave transponder can unify all three systems. The verdict on using RFID becomes even more devastating when examining the occurring scatter fields.

Today's RFID technology is a compromise, making clear the limitations of Hertz'ian wave technology. Energy transmission occurs at around 120 kHz, so that the useful near-field area is maximized, while information is sent back in the microwave spectrum, so that its emitter is small enough for storage in a credit card. People in the vicinity are exposed to the sum of both scatter fields. That is a fact, regardless of the biological effects of VLF- or microwave radiation. For precautionary measure, but also for reasons of efficiency, in the future all signal routes such as wireless LAN or Bluetooth are to be combined with a wireless energy transmission on the basis of scalar waves as the only way to eliminate scatter fields and to prevent biological effects.

7. FROM PRACTICAL EXPERIENCE

If the antenna efficiency is very low (i.e., in case of misadjusted antennae), the useful amplitude decreases while simultaneously antenna noise increases. According to the wave equation, the explanation could be different: From all the emitted waves the transversal waves decrease in favour of longitudinal waves. But the latter are being utilized in transponder technology, which is why unconventional antennae structures oftentimes allow for better results than common or time tested ones. Spherical antennae have proven especially useful in electrical transmission lines. The larger the sphere, the more the reception area for energy can be extended past the near field. This effect can be demonstrated experimentally quite convincingly. So far, high frequency technicians have only concerned themselves with maximizing the transversal wave so that it wouldn't be overwhelmed by noise. The construction of far range transponders calls for misadjusted antennae, the very opposite of what is being taught today in the field of HF technology, for inverted technical solutions.

And thus, the introduction and development of a new transponder technology first demands an extended view and secondly novel ways of high frequency technology education.

8. THE EXTENDED FIELD THEORY

It could be demonstrated that Maxwell's field equations contain an approximation and therefore only constitute a special case of a new, dually formulated and more universal approach. The mathematical derivations of the Maxwell field and the wave equation uncover what the Maxwell approximation is. The dual counter vortex, with its skin effect expanding and contracting towards the vortex current, also referred to as potential vortex, is being omitted. Is it capable of forming structures and propagates as longitudinal scalar wave in badly conductive materials such as air or vacuum. At relativistic velocities, the potential vortices are affected by Lorentz contraction. As scalar waves propagate longitudinally in the direction of an oscillating field pointer, the potential vortices experience a steady oscillation in size, consequently to their oscillating propagation. Imagining the field vortex as planar but coiled transversal wave, it follows from the oscillations in size and thus wavelength at a constant vortex velocity ($= c$) a permanent change in frequency, which is being measured as noise.

This noise turns out to be the potential vortex term omitted from the Maxwell equations. If, for example, a noise signal is being measured at an antenna this proves the existence of potential vortices. If, however, the Maxwell equations' scope of validity is left behind, misinterpretations and