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## ELECTRONICS AND TELECOMMUNICATION DEPARTMENT

# TECHNICAL NEWSLETTER

# SPARK 2K19

## INDEX



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# INTELLIGENT RAM (IRAM)

Given the growing processor-memory performance gap and the awkwardness of high capacity DRAM chips, we believe that it is time to consider unifying logic and DRAM. We call such a chip an "IRAM", standing for Intelligent RAM, since most of transistors on this merged chip will be devoted to memory.
The reason to put the processor in DRAM rather than increasing the on-processor SRAM is that DRAM is in practice approximately 20 times denser than SRAM. (The ratio is much larger than the transistor ratio because DRAMs use 3D structures to shrink cell size). Thus, IRAM enables a much larger amount of on-chip memory than is possible in a conventional architecutre.
Although others have examined this issue in the past, IRAM is attractive today for several reasons.
First, the gap between the performance of processors and DRAMs has been widening at 50% per year for 10 years, so that despite heroic efforts by architects, compiler writers, and applications developers, many more applications are limited by memory speed today than in the past.
Second, since the actual processor occupies only about onethird of the die ,the upcoming gigabit DRAM has enough capacity that whole programs and data sets can fit on a single chip. In the past, so little memory could fit onchip with the CPU that IRAMs were mainly considered as building blocks for multiprocessors.
Third, DRAM dies have grown about 50% each generation; DRAMs are being made with more metal layers to accelerate the longer lines of these larger chips. Also, the high speed interface of synchronous DRAM will require fast transistors on the DRAM chip. These two DRAM trends should make logic on DRAM closer to the speed of logic on logic fabs than in the past.

## POTENTIAL ADVANTAGES OF IRAM

### 1) Higher Bandwidth.

A DRAM naturally has extraordinary internal bandwidth, essentially fetching the square root of its capacity each DRAM clock cycle; an on-chip processor can tap that bandwidth.The potential bandwidth of the gigabit DRAM is even greater than indicated by its logical organization. Since it is important to keep the storage cell small, the normal solution is to limit the length of the bit lines, typically with 256 to 512 bits per sense amp. This quadruples the number of sense amplifiers. To save die area, each block has a small number of I/O lines, which reduces the internal bandwidth by a factor of about 5 to 10 but still meets the external demand. One IRAM goal is to capture a larger fraction of the potential on-chip bandwidth.

### 2) Memory Size and Width.

Another advantage of IRAM over conventional designs is the ability to adjust both the size and width of the on-chip DRAM. Rather than being limited by powers of 2 in length or width, as is conventional DRAM, IRAM designers can specify exactly the number of words and their width. This flexibility can improve the cost of IRAM solutions versus memories made from conventional DRAMs.

### 3) Board Space.

Finally, IRAM may be attractive in applications where board area is precious --such as cellular phones or portable computers--since it integrates several chips into one.

# MAGNETIC AMPLIFIERS

The electromagnetic device used for the amplification of electrical signals which utilizes the magnetic saturation of core principle and certain class of transformer's core non linear property is called as Magnetic amplifier. It is invented in early 1885 and is primarily used in theater lighting and it is designed with basic of design Saturable Reactor and hence can be used as saturable reactor in electrical machinery.

Principles of Magnetic Amplifier Circuits:

These are divided into two types as half wave and full wave magnetic amplifiers.

Half wave Magnetic Amplifier

Whenever DC supply is given to the control winding then the magnetic flux will be generated in the iron core. With the increase in this generated magnetic flux the impedance of the output winding will decreases, then the current flowing from the AC supply through the output winding and load will increases. Here it utilizes only half cycle of the AC supply; hence it is called as a half wave circuit.

At the core saturation point, at which the car is having a maximum flux it can hold, as the flux is maximum the impedance of the output winding will be very low making very high current to flow through the load.

Similarly, if the current through the control winding is zero, then the impedance of the output winding will be very high making no current to flow through the load or output winding.

Hence, from above statements we can say that by controlling the current through control winding the impedance of the output winding can be controlled such that we can vary the current through the load continuously.

A diode is connected to the output winding as shown in the above figure which acts as a rectifier, used for reversing the polarity of the AC supply constantly from canceling out control winding flux.

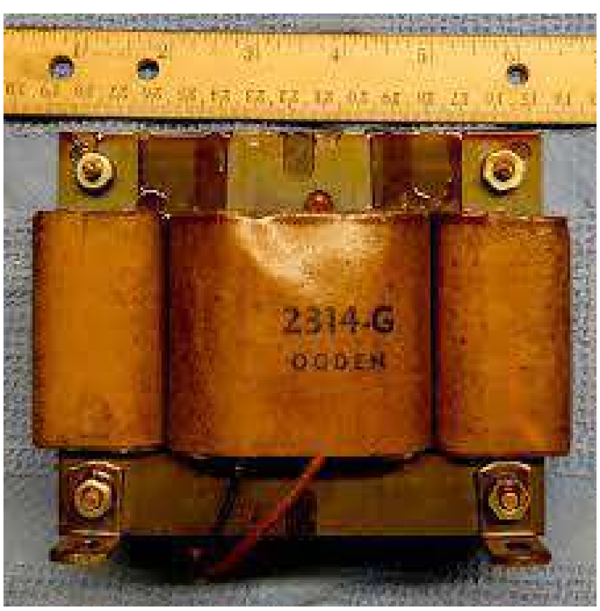
To avoid the cancelation and the direction of current flow through the secondary can be varied to reinforce two fluxes each other created by control winding and the output winding.

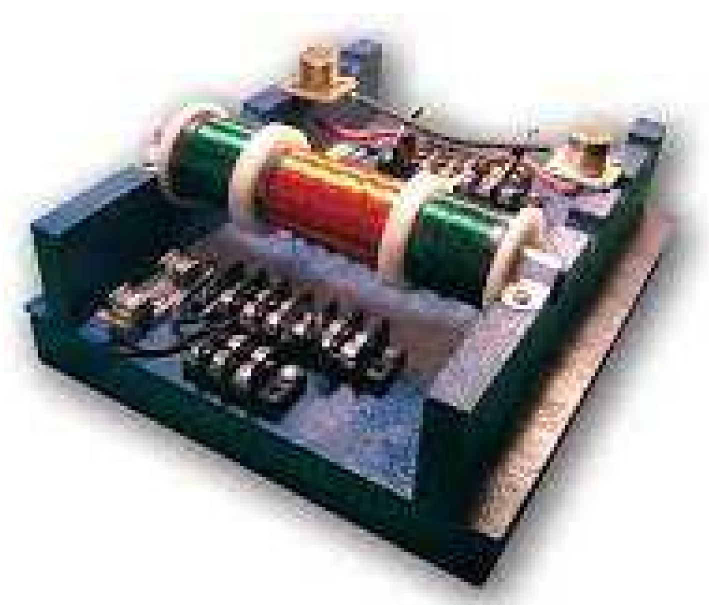
Full wave Magnetic Amplifier:

It is almost similar to the above half wave amplifier circuit, but it utilizes both half cycles of the AC supply, hence it is termed as a full wave circuit. Due to wound of the two halves of the output winding the direction of magnetic flux created by these two halves in center leg is same as direction of control winding flux.

Even though no, control voltage is supplied there will be some flux present in magnetic core, hence impedance of the output winding will never attain its maximum value and current through load never attain its minimum value. The operation of the amplifier can be controlled by using the bias winding. In case of vacuum tube amplifiers, certain part of its characteristic curve can be operated by the tube.

Many of the magnetic amplifiers will be having an additional control winding which is used to tap the output circuit current and give it as feedback control current. Hence this winding is used for giving feedback.



# PLASMA ANTENNA

Plasma antennas use partially or fully ionized gas as the conducting medium instead of metal to create an antenna. The advantages of plasma antennas are that they are highly reconfigurable and can be turned on and off. Hence research to reduce the power required to ionize the gas at various plasma densities is important and this has been achieved by various techniques including pulsing techniques. The power requirements for plasma antenna operation continue to decrease.

The same geometric resonances apply to plasma antennas as metal antennas. Plasma antennas of the same shape, length, and frequency of corresponding metal antennas will have the same radiation patterns. Plasma antennas have the advantage of reconfigurability.

High frequency antennas can transmit and receive through lower frequency plasma antennas eliminating or reducing co-site interference. Because of this principle, higher frequency plasma antennas can be nested inside lower frequency plasma antennas and the higher frequency plasma antennas can transmit and receive through the lower frequency plasma antennas. Higher frequency plasma antenna arrays can transmit and receive through lower frequency plasma antenna arrays. Co-site interference occurs when larger frequency antennas block or partially block the radiation patterns of smaller higher frequency antennas. With plasma antennas, co-site interference can be reduced or eliminated. The interference among plasma antennas can be reduced or eliminated by turning all the plasma antennas off (extinguishing the plasma) except the plasma antennas that are transmitting and/or receiving. This is not possible with metal antennas. A general rule is that when an incident electromagnetic wave upon a plasma antenna is such that the frequency of the incident electromagnetic wave is greater than the plasma frequency of the plasma, the incident electromagnetic wave passes through the plasma without attenuation. If the incident electromagnetic wave has a frequency much less than the plasma frequency, the plasma behaves similar to a metal. The frequency at which plasma behaves like a metal or a dielectric is reconfigurable.The plasma frequency is a natural frequency of the plasma and it is a measure of the amount of ionization in the plasma. It is defined and used throughout this book. Both plasma antennas and metal antennas increase in size as the frequencies they operate goes down to maintain geometric resonance and high efficiency. However as the frequency of operation of the plasma antenna decreases, the density of the plasma needed to operate the plasma antenna also goes down. A rule of thumb is that the plasma frequency should be about twice the operating frequency of the plasma antenna. Hence the plasma frequency goes down as the frequency of the plasma antenna goes down. As the plasma frequency decreases, the plasma antenna becomes transparent to a greater bandwidth of electromagnetic waves. In short as the plasma antenna increases in size, the RCS of the plasma antenna goes down whereas for the corresponding metal antenna, the RCS goes up as the metal antenna increases in size. This gives the plasma antenna some great advantages at low frequencies over the corresponding metal antenna. In addition plasma antennas do not receive electromagnetic noise greater than the plasma frequency since these frequencies pass through the plasma antenna.

Related to plasma antennas, plasma frequency selective surfaces, plasma waveguides, and plasma co-axial cables have been developed. Unlike metal frequency selective surfaces, plasma frequency selective surfaces have the properties of reconfigurable filtering of electromagnetic waves. This could have tremendous advantages to radome design. Plasma frequency selective surfaces can be reconfigured by varying the plasma density, varying the shape of the elements, or tuning any number of the plasma FSS elements on or off. Plasma wave guides and plasma co-axial cables can be stealth like plasma antennas, and they can operate at low frequencies, and be invisible at high frequencies. Plasma waveguides and co-axial cables can be feeds for plasma antennas. Plasma feeds as well as the plasma antennas have reconfigurable impedances. If the impedance of the plasma antenna is changed, the impedance of the plasma antenna feeds can be changed to maintain impedance matching.