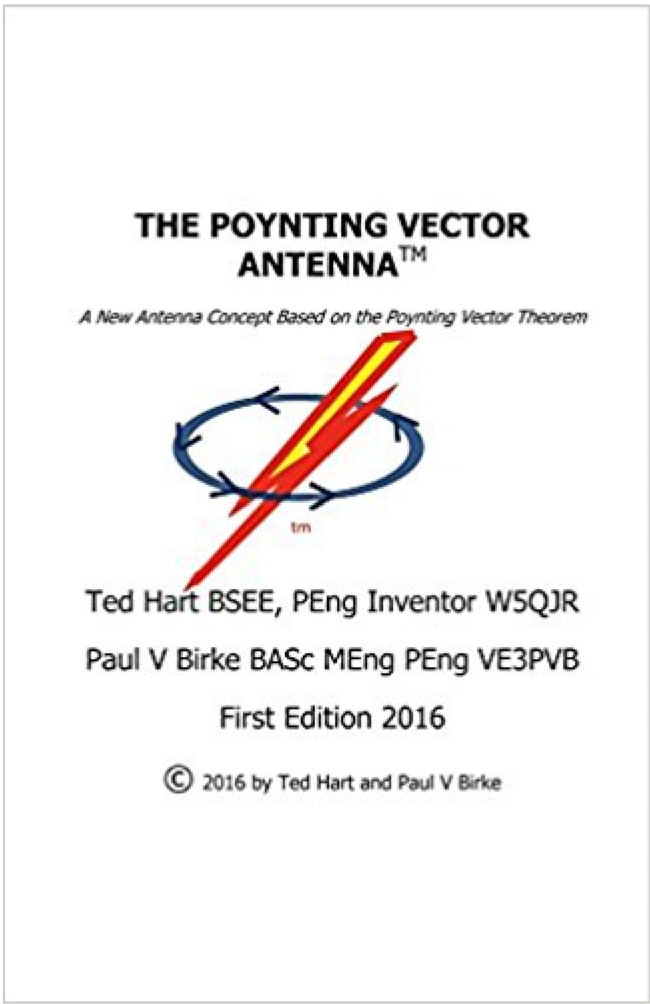
The Poynting Vector Antenna



Synopsis

The Poynting Theorem states that radiation is a product of the Electric (E) and Magnetic (H) fields of an antenna. The fields must occur simultaneously and have the proper curvature. This is accomplished in the Poynting antenna. A conceptual antenna has two hollow cylinders. A tuning coil resonates with the capacity between the two cylinders, thus developing a high voltage between the cylinders which creates the E field. The cylinders are very short with applied voltage on one end and open on the other. This allows RF current to flow on the cylinder which creates the H field. The two fields are in time phase and are orthogonal, thus satisfying the Poynting Theorem. The shape of the antenna may vary from two flat plates to a Flute configuration, and virtually any shape between. The significance of the Flute is that the shape follows a cosine function allowing both fields to be active along the length of the antenna. The Flute antenna may be tuned (simply by varying the inductance of the tuning coil) over a wide range. One of these has a total length of four (4) feet and may be tuned from 2.5 to 25 MHz with high efficiency (loss of less than 1 dB at the lowest frequency). The +/- 3 dB bandwidth is nominally one tenth (0.1) the operating frequency. Thus Q=10. The radiation pattern is isotropic and the polarization is elliptical. This virtually eliminates fading due to Faraday rotation for HF communications, and at VHF frequencies prevents nulls due to multiple reflections from large buildings. The optimum size of the antenna is typically 3% of a wavelength, but may be less if wide bandwidth is not a design criterion. Because the radiation pattern is isotropic and radiation occurs at the antenna, two (2) or more Poynting Vector antennas may be used to form a directional array while the individual antennas are not affected by mutual coupling of the H fields. The text of the book presents new physics concepts including a mathematical description of Radiation Resistance and suggested changes to MaxwellÃ¢â ¬â„¢s Equations. The book will be useful to every Ham operator, all Antenna Engineers, and every person concerned with Physics. Because this is a paradigm shift in antenna technology, the book is an excellent text for a graduate level antenna course.

Book Information

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Customer Reviews

Ted Hart has been an avid antenna experimenter for many years. His first antenna was a wire attached to a crystal set receiver circa 1940. He became a licensed amateur radio operator in 1948 (W5QJR) and is still active and has continued his antenna experiments. This book describes the Poynting Vector Antenna (PVA), which is the ultimate communications antenna, except for directional beams, and then two or more Poynting Vector Antennas in a non interactive phased array can provide that directivity. Circa 1988, Professor Hately and his colleagues published a paper in Electronics magazine describing the Crossed Field Antenna. Hart then began to exchange information with Professor Hately but in applying this information he was unsuccessful in causing a large model of the crossed field antenna to achieve the desired level of radiation. He then decided there must be a better way. The PVA is not conventional and, in fact, it is most gratifying to know that patent (US 6486846) was granted on the concept rather than a specific implementation. Patents 6864849 and 6956535 were issued later. Hart obtained a BSEE degree in 1957 at the University of Oklahoma. He worked for the Collins Radio Company for ten years, then for Omega-T-Systems and Scientific Communications. In these corporations, he worked as a Circuit Design and System Engineer, primarily related to airborne radar, radar remote systems for the FAA, and ground based portions of satellite systems. At Harris he became the Director of Engineering for a project valued at more than $130 Million. This was the ground terminal for the NASA TDRSS project. After retirement the majority of his time has been devoted to further development of the PVA. Now that the book is compete and both Hart and Birke are convinced that this is the ultimate antenna, no more experiments, analysis or development is deemed fruitful.Paul Birke attended the University of Toronto graduating with a BASc in Electrical Engineering in 1967. Paul obtained his Canadian Amateur Radio license (VE3PVB) after retirement He notes that his original degree from Toronto was with an electronics option; however, during the four years at the University of Toronto, he always maintained a strong interest in fields and the mathematics supporting their description and use. Ã Â He joined Westinghouse Canada and developed the Teledeltos Magnetic Field Mapper. Ã Â His MEng thesis at McMaster University entitled Analogue Technique for Mapping

Poissonian Fields formed the basis of his 1970 paper entitled Ã¢â ¬Å“A Capacitively Coupled Magnetic Flux Mapper. During this time at Westinghouse, Paul also worked on Schwarz-Christoffel methods for Conformal Mapping for applications to electric and magnetic field analysis. Ã Â At Westinghouse, Paul received the Gold Engineering Award in 1985 for developing the methodology, both engineering and manufacturing, that resulted in the EHV Shunt Reactor used for load stability on AC transmission lines. Ã Â Herein, electric and magnetic fields analysis proved critical to the successful development of this new product for Westinghouse Canada. Ã Â Also developed at this time was a nonlinear programming method for which Paul was given a special engineering award at Westinghouse. Ã Â During this time he was the R&D Manager for Large Power Transformers, Westinghouse Canada Ltd, Hamilton, Ontario. Ã Â Paul has co-authored a paper in the IEEE Transactions on Power Electronics entitled Ã¢â ¬Å“Distributed Magnetic Coupling Synchronizes a 25-Kv Stacked MOSFET SwitchÃ¢â ¬Â•, Jan. Ã Â 2000, Vol.15, N0.1, pp. 50-61. Ã Â The key to this circuit function is its novel magnetic coupling technique. Ã Â Design of the electric field between the Ã¢â ¬Å“sardine shapedÃ¢â ¬Â• stack elements was analyzed with special ABB finite element software for optimal inter-stack gap and electrode shape of the switch consistent with zero probability of air flashover. Ã Â The device was optimized in the presence of strong EM fields in its high-voltage stack composed of simultaneous magnetically-driven gating of its low-voltage IGBT switches.Ã Â Ã Â Paul joined Ted about four (4) years prior to completing this book. His background in Field Theory with TedÃ¢â ¬â„¢s experimental results have culminated in the development of the Poynting Vector Antenna.Ã Â

Most of the math in the book is way beyond me. The book needed more down-to-earth, how-to-build chapters. Still, I appreciate all the work and research that went into the book.

In the last few years I have been working on the theoretical aspects ofelectromagnetism by suggesting a possible escape from someinconsitencies present in the classical Maxwell's model.This nice book testifies that this revision may actually play animportant role in real life applications.Daniele Funaro

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