MOUNTAIN SPARK GAPS

NPARC—The Radio Club for the Watchung Mountain Area

Website: http://www.nparc.org
Club Calls: N2XJ, W2FMI

VOLUME 50 NO.1 January 2015

UPCOMING EVENTS

Regular Meetings

2/9 & 2/23
Monday 7:30
NP Community Center

ANNUAL AUCTION
February 27
New Providence High School

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
2nd Monday of each month at the
NP Senior & Adult Center
15 East Forth Street
New Providence

Informal Project Meeting: 7:30—9:00 PM
4th Monday of each month
Same location
Everyone is Welcome
If a normal meeting night is a holiday, we usually meet the following night.
Call one of the contacts below
or check the web site

Club Officers for 2015

President: KC2WUF David Bean
973-747-6116
Vice President:K2UI Jim Stekas
973-377-4180
Secretary: KD2EKN Tim Farrell
908-244-6202
Treasurer: K2YG Dave Barr
908-277-4283
Activities: W2PTP Paul Wolfmeyer
201-404-6914

On the Air Activities

Club Operating Frequency
145.750 MHz FM Simplex

Sunday Night Phone Net
Murray Hill Repeater (W2LI) at 9:00 PM
Transmit on 147.855 MHz
With PL tone of 141.3 Hz
Receive on 147.255 MHz
Net Control K2AL

Digital Net
First & Third Mondays 9 PM
Details as announced.

Club Internet Address

Website:http://www.nparc.org
Webmaster K2MUN David Berkley
Reflector: nparc@mailman.qth.net
Contact K2UI, Jim

MOUNTAIN SPARK GAPS

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Contributing Editors:
WB2QOQ Rick Anderson
WB2EDO Jim Brown

The following information is provided by Rick, WB2QOQ, who has been recording daily weather events at his station for the past 33 years.

TEMPERATURE -

Maximum temperature this December, 64 deg. F (December 1)
Last December (2013) maximum was 59 deg. F.
Average Maximum temperature this December, 43.5 deg. F
Minimum temperature this December, 19 deg. F (December 8)
Last December (2013) minimum was 15 deg. F.
Average Minimum temperature this December, 31.2 deg. F
Minimum diurnal temperature range, 3 deg.(33 -30 deg.) 12/20
Maximum diurnal temperature range, 27 deg. (64-37 deg.) 12/1

Average temperature this December, 37.4 deg.
Average temperature last December, 34.1 deg.

PRECIPITATION -

Total precipitation this December - 4.97" rain/melted snow; 0.2" snow
Total precipitation last December - 4.02" rain/melted snow; 8.6" snow.

Maximum one day precipitation event this December;
December 9 - 10, 0.2" snow.
Measurable rain fell on 14 days this December, 6 days last December.
Measurable snow fell on 1 day this December, 4 days last December.

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Rick Anderson
1/6/15
243 Mountain Ave.
New Providence, NJ
(908)464-8912
rick243@comcast.net

Lat. = 40 degrees, 41.7 minutes North
Long. = 74 degrees, 23.4 minutes West
Elevation: 380 ft.
CoCoRaHS Network Station #NJ-UN-10

2015 KID'S DAY

Thanks to Jon AE2JP for the photos

The King of Wire Antennas

Jim Stekas - K2UI

Previously, we discussed Serge Schelkunoff's transmission line antenna analogue, and used it to calculate the impedance of a half wave dipole. The reason Schelkunoff's approach works is that the solutions of Maxwell's equations for voltages and charge on the surface of a infinitesimally thin cylindrical wire are traveling sinusoidal waves, just as for transmission lines.

While Schelkunoff elected to solve an "analogous" problem, Harvard professor R. W. P. King tackled the problem head on, solving Maxwell's equations for real cylindrical wires as a superposition of some well chosen functions. In the end, King surpassed Schelkunoff in several impressive ways:

1. King lived to be 100, while Schelkunoff only made it to 95.
2. He was the thesis advisor of Dr. Jerry Sevick, W2FMI (SK), the king of baluns.
3. King's approach to solving antennas has evolved into the modern computer models we use today. Schelkunoff's theory has gone the way of the 6AU6, a fondly remembered classic.

Real wires are not infinitesimally thin, and only the voltage on the surface is exactly sinusoidal. To calculate the antenna impedance and the radiation pattern we need to determine the charge/current distribution on the wire that satisfies the following constraints:

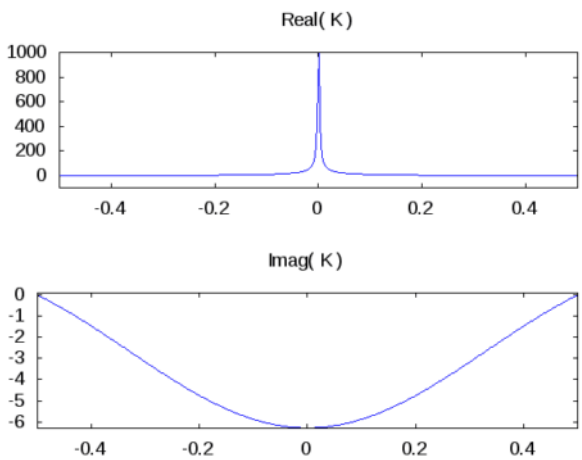
Sinusoidal voltage waves are induced on the wire surface.
Current = 0 at the ends of wires.
Discontinuous voltage "jumps" at feed points.

To understand King's contribution we need a little math is required. Assuming a time dependence of $e^{j\omega t}$ and a center fed antenna with ends at $\pm h$ the equation King attacked is:

$$A(x) = -jV_{\text{in}}\sin|kx| + C\cos(kx) = 60\int_{-h}^{+h} I(x')K(x-x')dx'$$

The left hand side gives the vector potential, $A(x)$, as a mixture of sinusoidal waves as required by constraint #1. The multiplicative constants are the driving voltage, V_{in} and an unknown constant C which will turn out to assume a critical value in order for current to be zero at the ends of wires.

$A(x)$ is expressed in term of the current on the wire, $I(x')$ and a "propagator" $K(x-x')$. Normally, $K(x-x') = \frac{e^{-jkR}}{R}$ where $R = | x - x' |$ and kR is the phase delay due to propagation from $x' \to x$. But we need to account for the fact that when $| x - x' | = 0$, $A(x)$ and $I(x')$ do not represent a single point, but are averages over the cylindrical wire surface of radius a in the neighborhood of x. Therefore, we should expect a minimum effective value of $R \approx a$, which King models by defining $R \equiv \sqrt{(x-x')^2 + a^2}$.



The figure above shows a plot of the real and imaginary parts of $K(x)$ using King's definition of R. Note that the real part is very sharply peaked around $x = 0$ and acts very much like a delta function. (In fact, it would be a delta function if a=0.) For any function $F(x)$, we have

$$\int_{-h}^{+h} F(x')K(x-x')dx' \approx \Psi F(x) + f(x)$$

where $\Psi F(x)$ is a large term arising from the the sharp peak and $f(x)$ is small and tends to be slowly varying. After some clever analysis, King determined that $I(x)$ could be expressed as a combination of the following three-terms:

$$M(x) = \sin(kh - | kx |) \qquad F(x) = \cos(kx) - \cos(kh) \qquad H(x) = \cos(kx/2) - \cos(kh/2)$$

King's beautiful “trick” is that for M(x) and F(x) the small term is proportional to H(x),

$$\int_{-h}^{+h} F(x')K(x-x')dx' \approx \Psi F(x) + \gamma H(x)$$

Therefore we can add in some H(x) to cancel the small terms:

$$\int_{-h}^{+h} \left[F(x') - \frac{\gamma}{\Psi} H(x')\right] K(x-x')dx' \approx \Psi F(x) + O(\varepsilon)$$

leaving $\Psi M(x)$ and $\Psi F(x)$ to build A(x).

King applied his three-term approximation to dipoles and multi-element arrays. His calculated input impedances and current distributions (!) are in close agreement with experiment.

These days, we still use King's integral equation for antenna modeling, but we solve it numerically on a computer. Next time, how NEC works.

SCIENTIFIC TIDBITS

Can Baboons Pass on Culture?

Humans are not the only ones capable of passing down knowledge from generation to generation, said researchers from the University of Edinburgh and Laboratoire de Psychologie Cognitive. As part of the study, baboons played a touchscreen memory game, the 2nd phase of which involved transmitting information to other baboons. This second group of baboons performed better at the transmission chain than the random testing, suggesting that they are capable of "cumulative culture" and can accumulate and share changes over time. Too bad the baboons in Washington are the exception to this study.

Stronger Cement

Stronger cement can be made from the waste product of sugar cane production. Researchers at the Niels Bohr Institute have created strong, more environmentally friendly cement from the waste ash from making sugar. Current cement is made from chalk and clay, but the sugar byproduct cement can withstand higher pressure and crumbles less. The same results are obtained by mixing fly ash from coal burning furnaces used in electric generation with the chalk and clay cement.

Electricity from Sewage

Electricity from sewage is not a pipe dream. Stanford University researchers have devised and done early tests on a way to generate electricity from sewage using naturally occurring microbes that produce electricity as they digest waste matter. Called microbial battery, the system could be used in treatment plants and to clean polluted lakes and streams. I wonder if electric eels could be a better choice.

A New Way to Cool Air

In hopes of developing more efficient technology to cool air, the U.S. Advanced Research Projects Agency for Energy has funded projects including one by U.K. based Sheetak, Conventional ACs use refrigerant liquids to absorb heat and expel it via electrical pumps and compressors. Sheetak's device, developed in part with ARPA-E funds, uses electricity and solid-state electronics to absorb heat. It could lead to cheaper ACs or refrigerators without moving parts that could keep medicines cool or food fresh in remote rural areas. Better still, it could lead to cheaper air conditioners and all other cooling devices while dropping the electrical demand. Hopefully their research is successful.

The Largest Volcano

The largest single volcano in the world has been confirmed by a University of Houston team. The scientists began studying Tami Massif, in the Pacific Ocean about 1,000 miles east of Japan, 20 years ago. They concluded from studies that the volcano, which covers an area the size of New Hampshire, is a single volcano, the largest ever found. If that volcano ever decides to become active, we may find that the "Pacific Ocean" will not be apply named and that most of the Pacific islands will be in deep trouble. The tsunami that its awakening will cause is too terrible to contemplate. Sleep well Tamu Massif.

Jim WB2EDO