

# STEM Society Meeting, September 11, 2012

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# 1 About the STEM Society and the STEM Society Website

STEM is an abbreviation for Science, Technology, Engineering and Mathematics. There are nearly 100 people on the mailing list, although a much smaller group attends any one meeting. We meet on the second Tuesday of each month at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The meetings are open to all. The start time is 6PM. We make presentations, have discussions, and sometimes have scientific demonstrations. The topics range from General Relativity to scientific experiments for kids.

The set of meeting notes may be viewed by going down the list of notes appearing on the front page of the site. These notes contains links to documents, which may be viewed or downloaded by clicking the link. Other documents can be reached by clicking the heading "Documents and Downloads" that appears on the left side of the front page. Then click on "documents." The meeting notes may also be viewed in an archive file in the list of documents. Most of the documents are PDF files. They may be viewed or downloaded to the computer by clicking, provided Adobe Reader is present, or another program capable of reading PDF files. There are often more documents available at the site than are listed under "Documents" because they may not have been added to the documents.htm file yet.

**The web site is:**

<http://www.stem2.org/>

**Direct to the documents list:**

<http://www.stem2.org/je/documents.htm>

**Direct to the archive file:**

<http://www.stem2.org/je/archive.pdf>

## 2 The September Meeting Announcement

The September meeting of the STEM Society will take place on the second Tuesday of the month, August 11, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible Topics are:

- (1) Electronics and electronics demonstrations.
- (2) Some calculations and graphics involving mathematical languages such as MatLab, MathCad, and general languages, geometry and so on.
- (3) Some Available Biological Laboratory Equipment.
- (4) Unknown Contributions by Members: Talks, Demonstrations, Apparatus, et cetera.
- (5) Book Reports.
- (6) Scientific Computer Programs.

### 3 Book Reports

[1] Nahin Paul J **The Science of Radio: With MATLAB and Electronics Workbench Demonstrations**, 2nd edition, 2001, TK6550 .N235 Linda Hall Library.

This is a nontraditional electronic circuits book designed for Sophomore electrical engineers. The book takes an historical approach and treats the history of electromagnetic waves and the development of AM radio. The approach is mathematical, featuring things like the Fourier transform and the Hilbert Transform. Some topics are: spark transmitters, sideband transmission, the coherer, and fourier analysis. The book is A joy to read. It gives revealing information about many controversial aspects of electrical engineering and radio history. Marconi is shown to be a bit of a fake and a ravenous expropriator of others work. Tesla made some early contributions, the invention of the induction motor and such, but later in life in seeking his former fame, he traded in a lot of nonsense, and even today is a subject of a Tesla cult which dispenses crazy rubbish about death rays and all manner of fantasy and conspiracy. The book is full of all kinds of interesting problems with MatLab solutions.

## 4 Representing Rotations and Translations With a Single Matrix Form, Using the Homogeneous Coordinates of Projective Geometry

I talked about how homogeneous coordinates, that is projective coordinates, are used in several applied calculations, specifically in transformations. The combined rotation and translation matrix represents what is called an affine transformation. So for example if  $s$  is the sine of some rotation angle, and  $c$  is the cosine. Then the following matrix represents a two dimensional rotation and translation by  $a$  in the  $x$  direction and by  $b$  in the  $y$  direction,

$$\begin{bmatrix} c & -s & a \\ s & c & b \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} cx - sy + a \\ sx + cy + b \\ 1 \end{bmatrix}$$

So we see also that a single rotation or a single translation can be represented in this form. Similar matrices may be used in three dimensions. Inverses can be written immediately by just changing some coefficient signs. More about computer graphics calculations can be found in **Computer Graphics and Geometry**

<http://www.stem2.org/je/graphics.pdf>

## 5 Eliminating Hidden Surfaces Using Barycentric Coordinates, and Topological Sorting

<http://www.stem2.org/je/triorder.pdf>

## 6 Solving an Infinite Resistor Problem

What is the resistance of an infinite ladder of resistors of  $R$  ohms each?

<http://www.stem2.org/je/electronicproblems.pdf>

Notice that from the supplied computer program that  $R_n$  converges to  $R_\infty$  very rapidly. This bears some relation to the fact that a transmission line has an impedance called the characteristic impedance that is independent of the length of the line.

## **7 Cécile Lagrandé: Experiments with Hydrochloric Acid, and Ecological Maps**

Muriatic Acid is 30 percent hydrochloric acid, with a PH of about -1. An attempt was made to identify the composition of rocks and minerals from reactions with hydrochloric acid. Cécil presented large colorful maps displaying the ecology of the world. These maps were obtained from USDA.

## **8 Maurice Smith: Chemistry and Mass Spectrography**

Maurice discussed mass spectroscopy, and contrasted the very large traditional machines with the smaller time of flight machines. We discussed some of the equipment that Rod Shirwise has obtained from a drug company as excess. His garage is full of this stuff: chromatography devices, vacuum pumps, mass spectroscopy attachment devices, and who knows what else.

## **9 Rich Kaufman and Rod Shriwise: The Windmills of Western Kansas**

Rod is from western Kansas and has a brother who runs the family farm. His brother is also locating water for fracking. A huge number of windmills have been installed out there, and the farmers are doing well with the income from windmills on their property. Rich talked about the KCPL involvement in this activity.

## **10 The Length of Pulley Belts and the Relation To Conic Sections**

<http://www.stem2.org/je/pulley.pdf>