Basic Antenna Modeling

Scott Robinson AG7T

Agenda

- Modeling Programs

- Modeling Hygiene

- Review of Dipole Antenna

- Let's do Modeling

15-Sep-2007   Mike and Key ARC Meeting

Modeling Programs

- There are 2 "computational cores" in common use
  - Mininec : Antenna Model, MMANA
    - Commercial implementations have many corrections to the original algorithm. IMHO, Antenna Model is clearly the best of these.
    - Was developed because NEC took too many resources for running well on a 640Kb DOS machine ;-)
    - Simplistic (and often inaccurate) Ground model
  - NEC: EZNec, NECWins, 4NEC2
    - Some of these allow access to full core functionality
    - Sommerfield-Norton Ground Model, the most accurate available
    - If you have a computer <4 years old computation time is not an issue

4

So what is the real difference?

- NEC and Mininec both use "Methods of Moments" solutions
  - i.e. antenna elements are segmented and then interaction between segments are calculated
- NEC and Mininec choose different boundary solutions to Maxwell's Equations
  - NEC has current at segment middle
    - Thus is inaccurate when large d/λ variations happen between adjacent segments or closely spaced elements
  - Mininec has current at segment ends
    - Thus is inaccurate when large angular variation happens at a segment junction
- You need to learn the limitations of what you are using and use techniques to avoid bad results!
  - I also try to use the appropriate "core" for a particular model. However, most of my modeling is done using NEC

15-Sep-2007   Mike and Key ARC Meeting

Resources

- ARRL EC-004 Antenna Modeling Course
- 2006 and later ARRL Antenna Handbook
  - W4RNL (L.B. Cebik) and AI1H (Frank Witt) chapters!
- Other ARRL publications on Antennas
- www.antennex.com

Modeling Workflow

- Pick your units: Meters, Feet, Inches
- Use consistent Geometry in your models
  - Cuts down on complexity if you have 1 way and stick to it… I use:
    - Straight Elements run along the Y axis
    - Height Elements (i.e vertical delta loop) are in the Y-Z Plane
    - Multiple elements are separated along the X axis
- Ensure adequate segmentation
  - Do convergence testing
- Check for Model or "core" Abnormalities
  - Average Gain Test

7

½λ Dipole: Model

Length ~1/2 λ

Feedpoint

Wires

Wire   Other

☐ Coord Entry Mode   ☐ Preserve Connections

No.	End 1				End 2				Diameter	Segs
	X (m)	Y (m)	Z (m)	Conn	X (m)	Y (m)	Z (m)	Conn	(mm)	
▶ 1	0	-0.25	0.3		0	0.25	0.3		#12	11
*										

Sources

Source

No.	Specified Pos.		Actual Pos.		Amplitude	Phase	Type
	Wire #	% From E1	% From E1	Seg	(V, A)	(deg.)	
▶ 1	1	50	50	6	1	0	I
*							

nd Key ARC Meeting

½λ Dipole: Current Distribution

EZNEC+

Current

Feedpoint

1

Impedance: ~73 ohms
Gain: 2.12 dbi

Let's Do Modeling

15-Sep-2007   Mike and Key ARC Meeting

Questions

15-Sep-2007

Mike and Key ARC Meeting