Change in the NEC–4.1 Distribution Procedure *

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After years of saying that the distribution procedure and restrictions on NEC-4.1 were about to change it has finally happened. The licensing of NEC–4 is now handled by the Industrial Partnerships and Commercialization (IPAC) office at LLNL. Information on the licensing procedure and a license form can be found at the website

http://www.llnl.gov/software/software.php

The program remains under copyright to the University of California that restricts release and distribution. However, after reviewing the code they have determined that export control is not needed except for countries on the DoE "sensitive country" list. Saddam need not apply. IPAC has increased the licensing fee to $950, but has set a $250 fee for academic and "non-commercial" use. The qualifications for "non-commercial" will be determined by IPAC, but it should ease the bite for people such as Amateur Radio operators.

When we were handling the distribution we could send out the code when we had received the registration form and a check or purchase order. IPAC does not accept purchase orders, but needs the license form and a check. They said that they may be able to accept credit card orders, but I don't think that has been tried yet. When they have everything that they need, they let me know that it OK to send the code.

There is not much information on the IPAC website on what is included in the NEC–4.1 package, but it is the same as before. We send out a CD with the source codes in single and double precision and the plotting programs for Windows. Executable files are included compiled for various matrix sizes, typically 1200, 2000, 3600 and 7500 segments for in-core matrix storage. A printed copy of the manuals is include as well as a scanned (bit-mapped) copy on the CD. Source files with Windows specific calls removed are included for unix systems.

In many ways NEC–4 is the same as NEC–2. The basic code reads an input file that describes the model and requests calculations of currents and fields. The code package includes programs to plot and check the model geometry and to plot impedance versus frequency on Cartesian or Smith charts with an option for rational-function interpolation over frequency, sometimes called "fast frequency sweep". There is also a program to plot radiation patterns in Cartesian or polar plots or as 3D patterns with hidden lines removed.

The major features that NEC–4 offers over NEC–2 are the ability to model wires in the ground, such as buried antennas, ground stakes and ground screens, and a model for wires with a thin insulating sheath. With NEC–2 you had to run a separate program to generate the Sommerfeld integral tables for ground. NEC–4 will look for a file and generate it if a matching file for the model is not found. When a frequency loop is run it will generate a family of files with incremented names. Then when a new run is made it will reuse the files if they match.

At least as important as these features is that NEC–4 fixes a problem in NEC–2 that

* This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

resulted in inaccurate results for wires with changing radius. NEC–2 is not accurate for either a single step in wire radius or a tapered change over several segments. NEC–4 is much more accurate in most cases of changing wire radius.

The matrix evaluation routines in NEC–4 have been rewritten to make them more stable for low frequencies. The single precision NEC–4 can be used in many cases where NEC–2 would fall apart. However, we still run most problems in double precision, since it gives more confidence and computers usually have enough memory. I do not know of any studies on the solution stability for single precision for models of 10,000 or more segments, where the reduced storage would really be important.

NEC–4, in the LLNL version, still does not have dynamic array allocation, but array dimensions are set in a parameter file. It is easy to change array sizes, but you need a Fortran compiler, or I will try to compile for sizes that are requested. There are also some new or modified commands, such as a catenary wire, an improved helix command and more control of the range of segments affected by GM. CM or CE commands for text can be used anywhere in the input file. Voltage sources and one or more incident plane waves can be combined for excitation. LE and LH commands have been added to compute near E and H along linear paths. They can be combined to evaluate line integrals of E or H along piecewise-linear paths. For large problems that cannot fit into RAM, NEC–4 uses a single direct-access file for the matrix where NEC–4 needed four copies of the matrix in sequential-access files.

NEC–4 remains a wire modeling program with a limited capability for modeling surfaces with the MFIE. It will not be of use for many currently important problems of modeling microstrip patch antennas or dielectric bodies. If anyone has questions not answered on the IPAC website they can contact me at burke2@llnl.gov or phone 925-422-8414.