

MIETAB: a Mie scattering program for Windows 3.x.

MIETAB calculates and tabulates Mie efficiency factors and phase functions for homogeneous spheres whose Mie size parameters lie between 0.01 and 400.0. Users must supply the real and imaginary parts of the index of refraction to be used, and can choose from four "modes" of calculation:

- 1) Use a single Mie size parameter (X).
- 2) Loop over up to 101 Mie size parameters.
- 3) Use a single radius and wavelength pair.
- 4) Loop over radius at a single wavelength.

In any of the four modes, a user can display a graph of the most recently calculated phase function. In modes (2) and (4) users can also display graphs of the variation of the extinction, scattering, absorption and backscatter efficiency factors. In mode (4) users may choose to calculate and plot actual cross sections rather than efficiency factors. In modes (3) and (4), users must enter the radii and wavelength in the same (length) units.

Users may choose to calculate phase function values at up to 181 equally spaced scattering angles in the range 0 to 180 deg. Choosing zero as the number of angles turns off the phase function processing. Phase functions are normalized so as to make their integral over solid angle equal to unity.

Numerical results may be saved in an ASCII formatted file for subsequent review or use, and may be copied into certain other documents via the Windows "clipboard".

There are provisions for adjusting the scale and offsets of the printed graphs. Since graphs are printed on the default Windows printer, said printer must of course have graphics capabilities.

MIETAB is Shareware, NOT Freeware. That means that you may use it without charge only for evaluating its suitability for your needs. A reasonable period for such an evaluation is about four weeks. If you wish continue to use the program beyond that time you (or your employer, if any) are both ethically and legally obligated to pay the licensing or registration fee of \$ 55 (see below for registration information). That fee is for the use of the Windows interface features incorporated in MIETAB, not for the Mie scattering algorithms incorporated therein. Those algorithms are available in the public domain (see W. J. Lentz, Applied Optics, 15, 668 (1976)). The developer of MIETAB for Windows will supply (to US Citizens only) a FORTRAN code for doing the Mie calculations at no charge upon receipt of an MS-DOS formatted diskette together with a self addressed and stamped diskette mailing container.

Payment of the fee authorizes you to use MIETAB as you could a book: only one "powered up" computer should run be capable of running a given registered copy at a time. Multiple users (if any) within an organization (whether it be a business or a school) should normally pay the fee separately for each more or less independently accessible copy of the program.

Although MIETAB is believed to be well behaved and to provide reliable results, its developer disclaims any and all liability for any problem whatsoever associated with its use or installation on any computer. If it fails, don't use it - you don't have to buy it to evaluate it in your environment. On the other hand, if you find it useful and think that your colleagues might agree, please feel free to pass along copies of the original

MIETAB.ZIP archive or even to tack it on your favorite bulletin board.

That said, the developer has a bit of pride as well as a lot of time invested in MIETAB. If a registered user encounters difficulties with its operation, the developer feels morally bound to try to find a solution to functional problems. That does not, however, mean that every little feature you wish were present will be provided upon request.

INSTALLATION

It is suggested that MIETAB be installed in and run from an exclusive directory so that any files it creates will be easily located. You can use any (legal) directory name you like, but for this discussion assume that the name you have chosen for the directory is C:\MIE.

MIETAB has two major components: MIETABxx.EXE and MIETAB.HLP. The simplest installation consists of creating the C:\MIE directory and placing all the files in the MIETAB.ZIP archive there. You can then run MIETAB from the Program Manager's File Run command combination by entering C:\MIE\MIETABxx.EXE as the command line.

To confuse matters somewhat, however, the developer had provided two versions of the main program: MIETAB20.EXE and MIETAB21.EXE. The former permits usage of the Windows CLIPBOARD, but suffers from non justified screen display of numerical results. The latter presents a more readable screen display, but does NOT support the CLIPBOARD. You can try both and see which one you prefer. In all other respects, the two versions are identical. REplace the "xx" in these instructions by either "20" or "21".

If you wish, you could also add MIETAB to an existing program group:

- 1) Create a new program item in an existing program group via the Program Manager's File New command chain.
- 2) Choose PROGRAM ITEM.
- 3) Fill in the blanks which appear in the popup dialog:

Description: MieTab
Command line: C:\MIE\MIETABxx.EXE
Working Directory: C:\MIE

Leave the Shortcut Key at "None", and click on the Change Icon button. The MieTab icon should appear and then you can click the OK button.

Finally, you can resize the Group box and close it if you like.

You could also create a new program group and then put MIETAB in it by the above procedure.

There is one optional file, MIETAB.INI, which you should place in your main Windows directory if you want to use it. MIETAB.INI is used to save the scale factors and printer offsets used in transferring graphs from the screen to a graphics printer. It also can be used to save your preferred number of angles for phase function calculations. (Whenever you change one of the just mentioned parameters, you will be asked whether you want to save them in the MIETAB.INI file. If you choose "Yes", then the file will be written into your main Windows directory, thereby overwriting and destroying any pre-existing copy.)

That is it. You are then ready to make and display the most amazing Mie calculations and results you have probably ever seen on a microcomputer - a few clicks of the buttons and there before your eyes you can see graphs of the efficiency factors vs size or the phase function vs angle.

LIMITATIONS

Windows interface limitations: Neither the main MIETAB20 window nor the graph displays can be adjusted in size while on screen, although they can be "minimized" and moved. The main numerical display window does not always display the data in nice vertical columns because of the variable spacing font. The latter is a recognized "bad aspect" of MIETAB, but the developer is stuck with it for now and doubts that many will want to work directly with those numerical data seen on the screen. If you do, then a simple way to get better looking aligned data is to "select" the data of interest and copy it into the Windows notebook. Alternatively you can just "save" the data to a file and print it for easy reference at your desk. Incidentally, numerical phase function values can be obtained only via the process of saving the results of a run in a separate file, although rough values may be estimated from the graphs. MIETAB21 has a nicer display, but can't copy to the Clipboard.

Technical limitations: The Mie subroutine used in MIETAB has been restricted to size parameters in the range 0.01 to 400.0. Over that range the results are expected to be valid to four or five digits, but the actual validity might vary if you use unusually large values for the real or imaginary parts of the index of refraction. Under some peculiar conditions, the Mie calculation routine may fail to reach convergence in after some 20,000 iterations. In such an instance you will see an error dialog on the screen. (If that happens, please send the developer information as to the indices of refraction and radii or size parameters that were in use.) MIETAB requires at least an 80286 cpu and a 80x87 math coprocessor . It will not function in the Windows "real" mode or if no 80x87 is available. MIETAB generated graphs are not themselves of publication quality. To create such graphs you will need some other program, but you can get the needed data by just saving the results of MIETAB calculations.

MISCELLANEOUS INFORMATION

MIETAB was created mainly using Borland International's Turbo Pascal for Windows. Obviously Borland International bears no any responsibility of any kind with respects to the performance of MIETAB. Although the actual Mie calculation method is mainly due to W. J. Lentz, he bears no liability with respect to this implementation. He is probably not even aware of it.

While running, MIETAB creates a temporary disc file named MIETAB.TMP for preserving some results. If MIETAB should for some reason terminate abnormally, that file probably will not be deleted as it is in normal program termination. You can delete the file if you wish or just leave it to be overwritten in the next run. Since it will normally show up in your directory only in the event of some sort of "crash", you might want to examine its contents using a text editor to see if it contains data of value to you before you erase or overwrite it.

MIETAB's graphs are drawn in a 400x400 pixel window. No intermediate processing is done to match the graphs to whatever printer you may have. They are evidently transmitted as a 400 by 400 array of "dots" and the size and placement of the image on the paper is determined by the resolution of the printer. For a Hewlett Packard 300 dots per inch laser printer, the graphs will be roughly 1.25 inches square and about 0.75 inches from the upper left corner of a sheet of paper. If you are using an older dot-matrix printer at 75 dpi resolution, then the graphs will be about 5 inches square. You can use the scaling multiplier factors and position offset options from ther graphing Print sub-menus to adjust the image size and position. You cannot adjust the printed image sizes by resetting the resolution of your

printer. The reason for that lies in the Windows commands used to transfer the bit map from memory to the printer. At present, MIETAB cannot send more than one graph to a single sheet of paper, and has no provisions for simultaneous display of more than one efficiency factor graph.

In the Options dialog there are three items in which you can:

1) Set the number of angles used for the phase function calculations. If you are not interested in the phase functions, set the number of angles to zero via the Options menu item. That may greatly accelerate the calculations.

2) Choose a "long form" for saving the phase function data. The standard arrangement for saving that data is one which saves paper when the results are printed by placing four (angle, phase function) pairs on each line. The "long form" option prints just one pair for each line of data in the ASCII output file. The latter is useful if you want to import the data into an external graphing program as a file of (X,Y) pairs. To do that you will first need to delete headers, etc from the file.

3) Choose to "check" the "Compute Cross Sections" option. If this option is checked (click if you use a mouse or TAB to it and toggle via pressing the spacebar), then absolute cross sections rather than efficiency factors will be displayed (or saved) if you also have chosen a "mode" in which you enter radius and wavelength. It is ignored if you select sizes only in terms of the Mie size parameters.

REGISTRATION

The one-time fee for permission to use MIETAB.EXE is \$ 55, payable to

August Miller
P.O. Box 3512
Las Cruces, NM 88003

Upon receipt of payment you will be sent a receipt which provides proof of license. Purchase orders from reliable firms or schools are acceptable. Payment of the fee entitles you to a directly shipped copy of any updated versions which may appear within one year of the payment date.

Frankly, the developer will be surprised if even as many as five people or organizations actually register their copies of MIETAB. It is a rather specialized program for scientific usage. However, for those who are involved in studies or use of the optical properties of aerosols, it is believed that MIETAB will allow the development of insights not easily reached via conventional separate "run now" and "plot later" environments. If you find it useful, please spread the word!

If you have questions, you may write to the developer at the above address or via electronic mail at internet address: amiller@nmsu.edu.

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Turbo Pascal for Windows is a product copyrighted by Borland International, Inc.

SUMMARY OF MENU ITEMS

MAIN MENU

"File"

- "New" : clears most data and resets most default values.
- "Save" : initiate save of current data in an ASCII file.
- "Save as...": about the same as "Save".
- "Exit": terminate execution of MIETAB; same as Close on syetem menu.

"Mode"

- "Single Mie Size-Parameter": enter an x, m and k data triplet.
- "A Range of Mie Size-Parameters": enter data for looping over x.
- "Single Radius and Wavelength": enter an r, m, k and wavelength set.
- "A Range of Radii at a Single Wavelength": enter data for looping over radius.

"Options": enter number of angles for phase function calculation, select "long form" for saving phase function data in an output file, and select the "cross-section" option.
(the cross-section option works only if both radius and wavelength data are relevant)

"Graph": select type of graph for immediate display.

"Q's or C's"

- "Extinction Q or C vs size": initiates display of a graph of Q(ext) vs X or R.
- "Scattering Q or C vs size": initiates display of a graph of Q(sca) vs X or R.
- "Absorption Q or C vs size": initiates display of a graph of Q(abs) vs X or R.
- "Backscatter Q or C vs size": initiates display of a graph of Q(bak) vs X or R.

"Phase Function": initiates display of phase function vs scattering angle graph.

"Reset": clears most parameters and resets most default values.

"Run": initiate calculation of data using most recently selected "mode" parameters.

"Help"

- "Index": index to MIETAB.HLP help file.
- "Startup info": minimal info on how to use MIETAB.
- "Help on help": calls up general help on using WIndows Help files.
- "About MieTab": sales pitch, etc from the developer.

GRAPH MENU (appears in the menu bar of the graph windows)

"Print"

- "Scale factors": set scale multipliers for printing a graph.
- "Set Offsets": set values for offset of the coordinate origin when printing a graph.

"Begin print": initiate print of graph via the default Windows printer.

"Help"

"Scaling info": hints on selecting scale factors values.

"Printing offset info": hints on selecting print offset values.