

Program VG Pest3

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1. Description

This program estimates the 3 parameters (a,n,qr) for the van Genuchten's Mualem soil-water characteristic curve formula by using the optimization subroutine LMDIF1 from the math library MINPACK (Argonne National Laboratory). VG Pest3 reads the Soil and Water Characteristic Curve (SWCC) laboratory values, water content (q, cm³/cm³) vs suctions (h, -cm water) and calculates the parameters such as:

$$q_c(h) = q_r + (q_s - q_r) * [1 + (a \cdot h)^n]^{-m}; \quad m = 1 - 1/n \quad (1)$$

and then calculates the unsaturated conductivity curve as:

$$Se = \frac{q_c(h) - q_r}{q_s - q_r} \quad (2)$$

$$Kr(Se) = Ku/Ks = Se^{0.5} [1 - (1 - Se^{1/m})^m]^2 \quad (3)$$

where:

q(h), q_c(h) = Measured and predicted water contents
Se(i,2) = effective saturation (j=2) for each pressure step(j=1)
SWCC(i,2) = Water content (j=2) for each suction step(j=1)
q_s, q_r, q_{r_c} = Saturated and Residual water content (_c=predicted)
K_s (cm/h) = Saturated hydraulic conductivity.

2. Program usage and output

The program runs in DOS mode and is written in FORTRAN (main engine) and C++ (interface). Command line UNIX and DOS versions are available from the authors.

Unpack the contents of the ZIP package on a directory. To run the program write "vg" at the command line and a graphical interface will open in the screen. Follow instructions as given. The program allows to select the initial parameters for the optimization. After convergence is reached, the program shows the results on a graphic mode.

3. Input file example

Before starting the program the input file must be written. The program input is contained in the input file "swcc.in" written in ASCII format. The user should edit this file replacing the contents with the values from the case to analyze. Please notice that this file must be saved in ASCII format for the program to run properly. This is a sample input file:

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```
'Lysimeter Soil 2-35cm 28/4/94' <----- Title (30 charac. max)
1.000 1.000 0.1 <----- alpha,n,qr
4.8 <----- Ks(cm/h)
```

0. 0.475108 <----- (hi,qi);NOTE: For i=1 -> (0, qs)
3.81 0.442734
13.81 0.401439
28.81 0.372662
53.81 0.343165
103.81 0.315827
203.81 0.292086
403.81 0.274101
15000 0.2056

4. Program License

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