

Shooting Method Discussion

Jacob Turner

Computational Methods III

10/29/2018

The shooting method can be used to solve for any variable in a system of differential equations. In this particular instance it replaces a search algorithm that adds or subtracts to the input of the Runge-Kutte-Fehlberg depending on if the result is above or below the known final answer. The shooting method is much simpler and will find the correct final answer to the system of differential equations with significantly less computational effort. The shooting method works by determining the difference between the target and answer and iterating to decrease this difference until it is within a certain precision of the target answer. A second general subroutine was created to house the shooting method algorithm used to solve the system for a specific variable. Within the subroutine the secant formula is used immediately to determine a new s value that depends on the s old values and the error values that are determined from the RKF algorithm. The RKF algorithm is then called exclusively in the calculation of the new error which is determined by finding the difference between the result of the RKF method and the target answer. This error is then used to determine if the shooting method has converged to the correct final solution by comparing it to a small epsilon value which holds a level of precision that satisfies the user. If the precision is not met the subroutine reassigns the s and error values to the older variables and is iterated again until it converges within a precision.

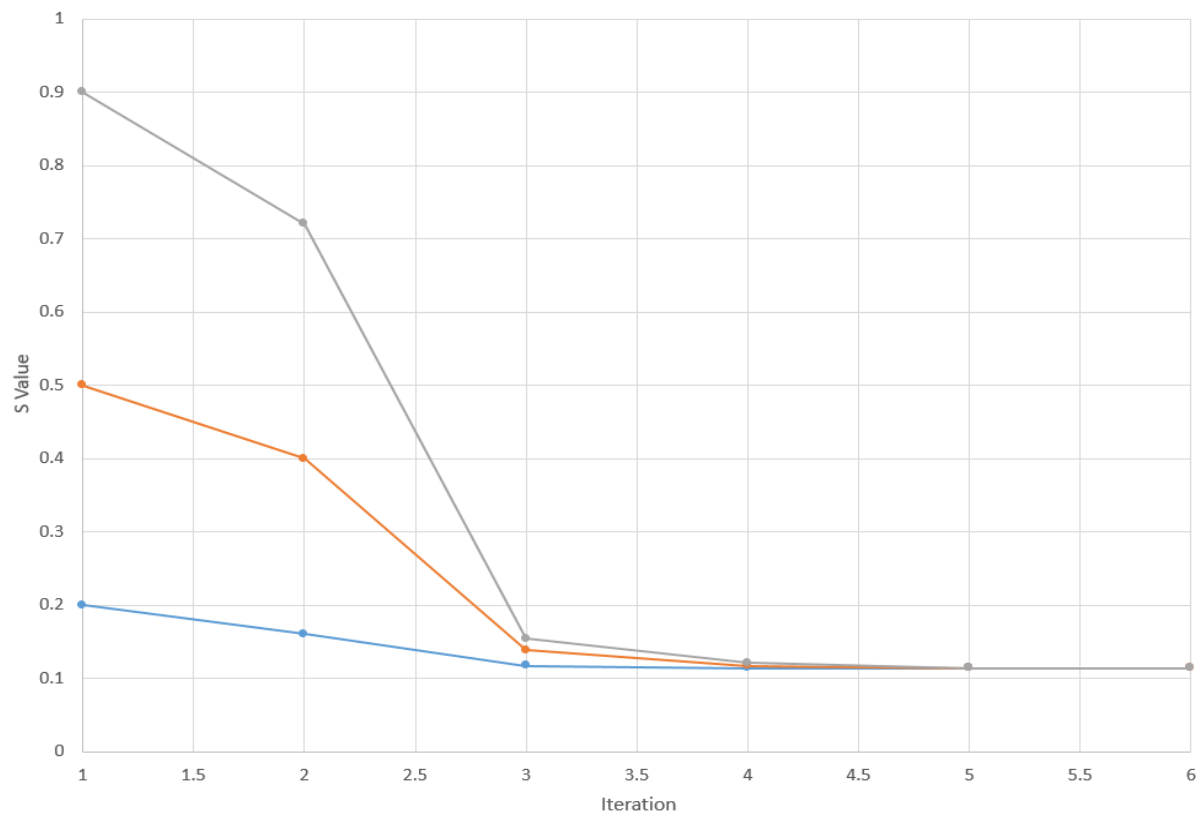


Figure 1: The rate of convergence of the S values with various starting concentrations.

Executable and Output:

Script started on 2018-10-29 11:22:10-0700

```
jdt385@scid15-lab10l: ~/Documents[01;32mjdt385@scid15-lab10l[00m:[01;34m~/Documents[00m$ gfortran[Krtramn[KKn final.f90 -o f.exe
```

```
jdt385@scid15-lab10l: ~/Documents[01;32mjdt385@scid15-lab10l[00m:[01;34m~/Documents[00m$ ./f.exe
```

Iteration,S_value

1, 0.9000

2, 0.7200

3, 0.1542

4, 0.1208

5, 0.1138

6, 0.1135

shooting method complete.

```
jdt385@scid15-lab10l: ~/Documents[01;32mjdt385@scid15-lab10l[00m:[01;34m~/Documents[00m$ exit
```

exit

Script done on 2018-10-29 11:22:39-0700