



Solver Block Calculation Methods

Calculations using **Solver Blocks** have been improved and updated for version 6.5 of the ProTreat® simulator. The dialog is more streamlined and new calculation methods have been added.

In previous versions, ProTreat offered three calculation methods; Interval Halving, Linear Interpolation, and Quadratic Interpolation. These methods use boundaries (brackets) that are specified in which the solution must exist.

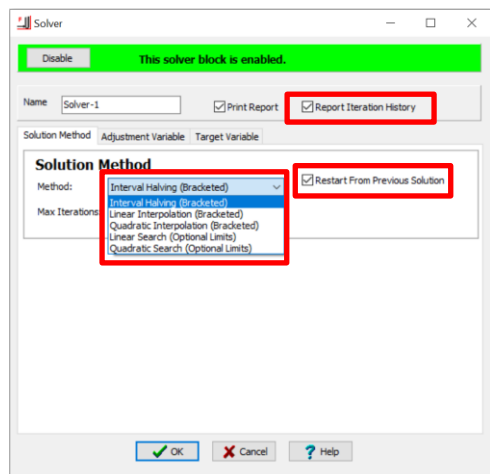


Figure 1. Solution Methods in **Solver Block**

Two new methods have now been added which no longer require the user to set limits: Linear Search and Quadratic Search (Figure 1). These methods calculate a gradient to project the next estimate of a solution. The limits have been made optional (Figure 2), so you are still able to limit the range for the projection. Additionally, the step size for the projection can be limited by a specified amount to keep the projections from becoming unstable and creating problems with the rest of the simulation.

As seen in Figure 1, there is also a new feature to *Restart From Previous Solution*. Similar to recycle and column restarts, the **Solver Block** is now able to restart the calculations from the solution of a previously converged simulation. This greatly helps to improve convergence time for simulations where the results do not change dramatically, especially when using the new search methods.

Figure 1 also shows a checkbox called “*Report Iteration History*”. This keeps track of and reports the results for each step the **Solver Block** takes (shown in

Figure 3). This is very helpful in determining where other solutions may be as well as helping you to create a graph for each step of the Adjust Variable vs. the resulting values of the Target Variable. Understanding these dependencies can help in setting up advanced control systems.

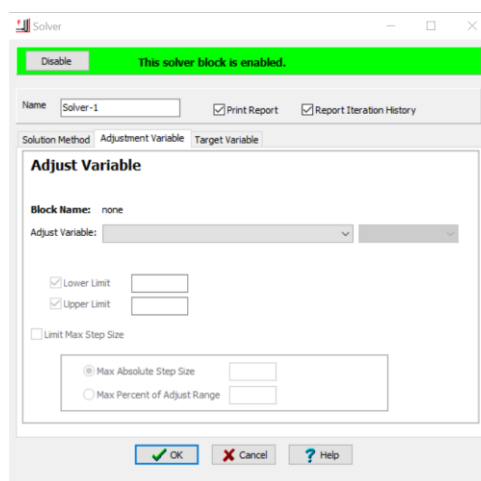


Figure 2. Adjust Variable in **Solver Block**

Solver-1 [Solver Block]
Adjusted Block: Inlet-1
Adjusted Variable: Component Flow: Hydrogen Sulfide
Lower Limit: 0.01 lb/hr
Upper Limit: 100 lb/hr
Solution Method: Linear Search (Optional Limits)
Maximum Iterations: 30
Target Stream: Material Stream 1
Target Variable: Acid Gas Loading
Loading Option: Hydrogen Sulfide
Target Value Specified: 0.500
Target Value Achieved*: 0.500
Tolerance: 1.000E-02
Iterations Used*: 3
Original User Spec. for Adjusted Variable: 1.000 lb/hr
Adjust Final Value*: 14.300 lb/hr

Iteration History	Adjust Value	Target Value	Target Error	Note
1	10.000	0.350	-0.150	Restart Value
2	10.100	0.353	-0.147	
3	14.300	0.500	7.772E-16	

Solver calculations completed normally.

Figure 3. Iteration History Output

PROTIP: When the optional limits are in place for the two new Search methods, those limits are not checked before continuing with calculations as was done in the previous interpolating methods. This helps reduce the iteration count and convergence time, especially when using restarts in the **Solver Block**.

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