

Information for Instructors

- Because iterative methods are so important in solving so many of today's real world problems, it is important that a student's first exposure to iterative methods be positive and as simple, yet as complete, as possible. With this in mind, the main purpose of the tutorials and Java applet is to allow for easy visualization and experimentation. In more detail, primary purposes of the applet and the companion tutorial are that:
 - The applet allows for clear and simple visualization of what each iterative method is doing, in particular, how eigenvectors and eigenvalues affect the convergence (or non-convergence) of each method. Repeatedly zooming-in on the converging approximations also helps students to literally see that iterative methods don't normally find a solution exactly, rather each iteration gives you a better approximation, and you have to decide how good is good enough.
 - The applet does the basic computations of each iteration, to allow the user to easily and quickly do as many iterations as desired, without the practically impossible burden of doing more than a few iterations by hand (even with the help of a calculator). This allows for very easy experimentation that would often require multiple iterations. Several of the given exercises take advantage of this fact and allow the students to explore a variety of underlying ideas and considerations that would otherwise be impossible to deal with. Again, the applet makes it easy for students to see that iterative methods produce approximations rather than exact solutions.
 - The applet allows for a simple comparison of the three iterative methods considered, including how their rates of convergence compare.
 - The applet is designed for free and very easy use. In particular, there is virtually no learning curve and there is no software, calculator, etc. for the student or department to purchase. The only requirement is a computer with an Internet connection, and the Java Plug-in, which is free and easy to install.
- There are four files in addition to this one:
 - Tutorial—Part 1
 - Introduction to Iterative Methods for Solving $Ax = b$
 - Jacobi's Method
 - Gauss-Seidel Method
 - Tutorial—Part 2
 - Convergence Analysis of Iterative Methods
 - Analysis of Jacobi and Gauss-Seidel Methods for 2×2 Systems
 - SOR Method
 - Homework Exercises
 - Information on How to Use the Java applet
- Often when introducing iterative methods, only the Jacobi and Gauss Seidel Methods are considered. The SOR Method is consequently given at the end of Part 2 of the tutorial, as an optional topic.

- Here are a few suggestions to instructors on how to use the files and the applet. The instructor can:
 - Print out whatever files he/she wants his/her students to have, then photocopy and distribute them.
 - Give his/her students the link to the main webpage
<http://math.pepperdine.edu/~dstrong/Java/IterativeMethods>
 and give information about what files to access and what problems to do.
 - From the class homepage (or in class), give his/her students the links to the specific files to use/read.
 - Save whichever files he/she wants, and give his/her students the links and any other pertinent information on the class homepage.
 - Cut out parts of the tutorial, rather than give the students the tutorials exactly as written. Here are two possible examples:
 - Some instructors might want their students to derive some or all of the formulas given in tutorial, so these instructors could simply cut out the parts of the tutorial that give the derivations and the formulas.
 - Other instructors might want their students to see the formulas (and their derivations) for the Jacobi Method, but then require their students to derive the corresponding formulas for the Gauss-Seidel Method.
 - Have the student to submit a snapshot of the student's work (the applet) as part of a HW assignment—one way of taking a snapshot of the applet is by pressing **Ctrl-Alt-PrintScreen** (which creates a copy of the screen), and then pasting it into another file, such as a MS Word file (**Ctrl-V**).

- The homework exercises are comprised of problems corresponding to Part 1 of the tutorial (Exercises 1 – 6) and exercises corresponding to Part 2 of the tutorial (Exercises 7 – 18). Each homework problem was very carefully and thoughtfully designed to both arouse the student's curiosity and challenge him/her, taking advantage of the applet which does most of the tedious computation and which allows for clear visualization. There are several possibilities for student exercises:
 - Simply assign some of the problems from the given Exercises, including possibly assigning only certain parts of some of the Exercises.
 - Design your own problem to be solved with the help of the applet, or modify a problem from the given Exercises and assign it.
 - Allow students to use the applet in working homework exercises from the class textbook that deal with solving 2 x 2 systems.