A Java Applet and Tutorial for the Jacobi, Gauss-Seidel and SOR Methods

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General goals

- Help students better visualize the theory, including interaction with the pictures/plots.

- Facilitate experimentation: "What if …?"

- Assist students in doing thoughtfully designed problems: help students to focus more on underlying theory than on mundane details for certain problems.

Specific purposes of applet and tutorial

- Introduce Jacobi, Gauss-Seidel and SOR Methods to beginning Linear Algebra or Numerical Analysis students.

- Emphasize key ideas of iterative methods.

- Show importance of linear algebra ideas in methods, such as eigenvectors and eigenvalues.

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- Well designed homework problems are critical to accomplishing these purposes.
- Technology should be easy to use, inexpensive, and "to the point."

What happens? Why?

- First look at what the methods do, then later develop theory that explains why.

- Some aspects of the methods and what they do can be discussed first without, then later with, the deeper theory, in particular, eigenvectors and eigenvalues.

The applet and tutorial are located online at

http://math.pepperdine.edu/~dstrong/Java/IterativeMethods

Basic ideas investigated using applet

- Use current estimate to find better estimate.
- In practice, we often find approximations, not exact values.
- Variations of methods produce variations in results.
- Do these schemes always work? (So when do they work?)
- By the way, order of equations in $A\boldsymbol{x} = \boldsymbol{b}$ matters.
- How does initial "guess" affect process?
- What other parameters affect things?
- Visualization of eigenvectors' and eigenvalues' involvement in convergence of approximations.
- At what rate does the error tend to 0?

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