Scientific Computing with Matlab

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Math 365

http://math.boisestate.edu/~calhoun/teaching/Math365_Spring2015

Textbook and other course material

- Required text : *Numerical Computing with Matlab,* Cleve Moler (Mathworks, Inc.). *Available online*.

- Required software : The Matlab software (available from Mathworks, Inc)

- Recommended text *: Learning Matlab*, by Toby A. Driscoll (published by SIAM). Buy directly from SIAM, or check out the *electronic version* from the BSU library.

- Online *Matlab tutorials* developed for this course

See the course website for links to the above

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- Practical and theoretical aspects of solving common math, science and engineering problems that cannot be solved easily by hand or using a calculator.

  - Using elementary functions in Matlab
  - Solving linear systems
  - Root-finding for scalar problems
  - Interpolation of data
  - Function minimization
  - Solving ordinary differential equations

Computational Science

"Computational science now constitutes what many call the third pillar of the scientific enterprise, a peer alongside theory and physical experimentation." (Report to the President).

There is hardly a field of engineering or science that has not been touched by computational science. Weather forecasting, automobile and airplane flight, natural hazards modeling, medicine, and so on.

What is scientific computing?

Sidebar 1
Definition of Computational Science

As a basis for responding to the charge from the Office of Science and Technology Policy, the PITAC developed a definition of computational science. This definition recognizes the diverse components, ranging from algorithms, software, architecture, applications, and infrastructure that collectively represent computational science.

Computational science is a rapidly growing multidisciplinary field that uses advanced computing capabilities to understand and solve complex problems. Computational science fuses three distinct elements:

- Algorithms (numerical and non-numerical) and modeling and simulation software developed to solve science (e.g., biological, physical, and social), engineering, and humanities problems

- Computer and information science that develops and optimizes the advanced system hardware, software, networking, and data management components needed to solve computationally demanding problems

- The computing infrastructure that supports both the science and engineering problem solving and the developmental computer and information science

Report to the President : "Computational Science : Ensuring America's Competitiveness", June 2005.

How does Matlab fit into this?

- Matlab, along side more traditional programming languages such as C, C++, Fortran has become one of the major platforms on which computational science is carried out.

- Originally designed as a computational "laboratory" for easily solving matrix equations, it has now branched into most areas of mathematics, with numerical tools for solving a wide range of complex problems in science and engineering,

- Integrated graphing capabilities make it an ideal tool for quickly prototyping codes and visualizing output,

- Easy manipulation of vectors and matrices.