**CS/MATH-5485 (CRN 82500)**  
**Numerical Analysis and Software:**  
“Numerical Optimization and Inverse Problems”  
**Fall 2016**

### Essential information.

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<th>Instructor</th>
<th>Dr. Adrian Sandu</th>
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| Lecture          | Tue-Thu 9:30am–10:45am, Lavery Hall (WLH) 345 |
| Web Page         | http://www.cs.vt.edu/~asandu/Courses/CS5485/CS5485.html |
| Prerequisites    | Graduate standing. Math 4445, 4446 or equivalent. |
| Final Exam       | Section 09T, 10:05am–12:05am, December 15, 2016 |

### Textbooks.


- The instructor will hand in material supporting Inverse Problems and applications.

### Additional material.


### About the course.

We will study numerical optimization methods and relevant software and will apply them to the solution of inverse problems. The proposed schedule of topics throughout the semester is below; the actual pace of the class may differ.

- Review: solution of linear systems, solution of nonlinear systems by Newton’s method and variants.

- Global convergence:
- line search approach;
- trust region approach.

• Solving unconstrained optimization problems:
  - quasi-Newton methods;
  - nonlinear conjugate gradient methods;
  - techniques for large-scale problems.

• Solving constrained optimization problems:
  - first and second-order optimality conditions;
  - quadratic programming and sequential quadratic programming;
  - penalty and augmented Lagrangian methods;
  - interior point methods.

• Inverse problems:
  - deterministic formulation: least squares problems;
  - probabilistic formulation: maximum likelihood estimation;
  - direct and adjoint sensitivity analysis;
  - PDE-constrained optimization.

### Grading.

The grade will be based on homework projects. There will be no formal midterm or final exams.

### Disclaimer.

Some information given to you in class may supersede the information in this syllabus or in the web page.

### Student Complaints and Academic Misconduct.

Students are expected to comply to the Honor Code. If you have any problems, the first step is to discuss with me directly.

### Disabilities.

Please let me know if you have a disability which requires special arrangements.