

# Numerical Linear Algebra, Year 3, M-Level

## Aims

Many mathematical models of physical, biological and financial phenomena result in a numerical approximation problem. These problems may lead to a large system of simultaneous equations that needs to be solved. In this course we will consider solution and approximation techniques for solving large sparse matrices, matrices with many zero entries. We also consider numerical algorithms for the solution of eigenvalue problems.

## Objectives

At the end of the course you should be able to apply a variety of numerical methods for finding approximations to linear systems of equations. Appreciation for the need of such methods will be understood. You should have a good knowledge of the stability and accuracy of such methods when applied in a floating point arithmetic setting.

Computational skills will have been developed using MATLAB.

## Syllabus

- **Matrix Analysis:** Vector norms, Matrix norms, Canonical forms, Spectral radius
- **Floating Point Arithmetic:** Stability, Conditioning
- **Direct Methods for Linear Systems:** Back substitution, Gauss elimination, Pivoting, Cholesky factorisation
- **Iterative Methods:** Jacobi, Gauss-Seidel, Conjugate Gradients
- **Eigenvalues:** Basic properties, Hessenberg form, Power Methods

## Suggested Reading

*Numerical Linear Algebra*, L. N. Trefethen and D. Bau III, 1997, SIAM.

*Matrix Computations*, G. H. Golub and C. F. Van Loan, J. Hopkins University Press.

*Matrix Analysis*, R. A. Horn and C. A. Johnson, C.U.P.

## Teaching

Lecturer	Dr D. A. Kay	Man 2A14
Email	<i>d.a.kay@sussex.ac.uk</i>	
Web	<i>www.maths.sussex.ac.uk//Staff/DAK/</i>	
Telephone	01273 – 877442	
Office Hours	Tuesday 10:00-10:50	Man 2A14
	Monday 14:00-14:50	Man 2A14
Lectures	Monday 15:00-15:50	Eng1-AS02
	Wednesday 9:00-10:50	Pev1-1A01

## Third Year Assessment

This course is assessed by four problem sets given out in weeks 2,4,6 and 8, each carry 5% of the final mark and a final exam carrying 80%.

## M-Level Assessment

This course is assessed by four problem sets given out in weeks 2,4,6 and 8, each carry 2.5% of the final mark, a project carrying 20% and a final exam carrying 70%.

Note: In the weekly sheets starred questions will carry the 2.5%.