All. n. 1 - Verbale 3

PTA - Tecnologo di ricerca a tempo determinato
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Elenco domande N.1

1. La candidata/il candidato illustri un metodo di discretizzazione per la soluzione numerica di un'equazione di flusso in mezzi porosi.
2. La candidata/il candidato discuta la propria conoscenza del linguaggio Fortran per applicazioni numeriche.

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Elenco domande N.2

1. La candidata/il candidato illustri gli aspetti di implementazione della soluzione numerica di equazioni di flusso e deformazione in mezzi porosi con riferimento alla soluzione iterativa dei sistemi lineari che ne derivano.

2. La candidata/il candidato illustri la propria conoscenza del linguaggio Matlab per applicazioni numeriche.

All. n. 3 - Vol. All. n. 3

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Preconditioning eigenvalues and some comparison of solvers

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Abstract

Preconditioning techniques are discussed for symmetric eigenvalue problems. The methods Davidson, Jacobi–Davidson, Rayleigh quotient iteration, and preconditioned Lanczos are considered. Some relationships are given between these different approaches, and some experimental comparisons are done. Jacobi–Davidson appears to be efficient in both expense and storage. A hybrid method may be helpful for the case of a poor initial vector.

MSC: 65F15; 15A18

Keywords: Eigenvalues; Preconditioning; Davidson's method; Jacobi–Davidson

1. Introduction

Finding eigenvalues is an important task in scientific computation. There are many applications in physics, chemistry, and engineering. These include computing energy levels of atoms, finding vibrational states of molecules, and determining how buildings will vibrate during earthquakes. Frequently scientists wish to know some eigenvalues of very large matrices. For such problems, Krylov subspace methods are well known. The Lanczos algorithm [9,22] is a Krylov subspace method for symmetric problems. For nonsymmetric matrices, the methods are Arnoldi [1,26,35] and nonsymmetric Lanczos [9,26].

For large systems of linear equations, preconditioning is an important technique for improving the spectrum. While it is not as straightforward, preconditioning can also be used for eigenvalue problems. Methods that use preconditioning are no longer strictly Krylov methods, although they are generally still related. In cases where an effective, inexpensive preconditioner is available, preconditioning can significantly improve the convergence and provide a better method.

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