A Policy Iteration Algorithm for Pricing the American Option

E. Mageirou[1], P. Vassalos[1], N. Barakitis[1]

[1] *Athens University of Economics and Business, Athens, Greece.*

Abstract

The pricing of American option is a challenging problem especially for high dimensional cases, since finite difference and binomial tree techniques become impractical in presence of multiple factors (curse of dimensionality). Even in the one factor case, the problem is still challenging since the value of the option is determined from the solution of Black-Scholes equation on the free boundary condition (the optimal exercise boundary).

We present an alternative way for pricing American style options based on the policy iteration dynamic programming algorithm which leads to monotonically increasing value functions. We mention that a policy in an American option can be specified by an exercise boundary, the option being exercised at the instance the underlying asset first reaches the boundary. Under reasonable assumptions, we show that the algorithm converges quadratically, and we present a numerical implementation which indeed exhibits fast convergence.

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Weighting Assessment of Vulnerability Index Parameters of Reinforced Concrete Constructions

Fatma Imene Belheouane[1], Mahmoud Bensaibi[2]

[1] *Department of Civil Engineering, University of SAAD DAHLAB (Blida1), Blida, Algeria, fimenebb@yahoo.fr*
[2] *GITRAMA, voie C zone Industrielle B.P 143 Rghaia, Alegria*

Abstract

Seismic vulnerability assessment of reinforced concrete (RC) existing structures can performed through the use of reliable tools this is in order to reduce damages in case of an earthquake event.

In this paper, a vulnerability index method has been applied to this type of building for the Algerian case according to the national seismic regulations (RPA), by identifying the most important parameters that have an influence on the seismic behavior of such structures. Weighting factors are then assigned to each parameterin order to evaluate the vulnerability index, which allows classifying each assessed structure according to a proposed classification. The weighting factors were estimated by a dynamic analysis using ten seismic records. Lastly, this method was implemented using developed numerical code and performed using several examples to show its efficiency.

Keywords: Vulnerability index, reinforced concrete construction, finite element, dynamic analysis, earthquake, damage.

Modeling and simulation of eddy current testing of aeronautical tubes

S Bennoud[1], M Zergoug[2]

[1] *Laboratory of Aircrafts, University of Saad Dahlab, Blida 1, Blida, Algeria*
[2] *C.R.T.I (ex (CSC)), Cheraga, Algeria*

Abstract

Eddy current testing can be used such as a perfect tool to characterize defects in materials. In particular, on fields of advanced industry those require a maximal safety (aeronautics, aerospace, nuclear...). However, the sensitivity of the characterization process is highly dependent on the probe choice and the operation frequency.

In this context, it is necessary to identify and control cracks in metallic tubes used in aeronautic, especially those prepared by aluminum.

Detection of axial cracks in tubes continues to be a major challenge in aeronautical studies. The general idea is to provide a theoretical and computational framework for the efficient and approximate treatment of three-dimensional electromagnetic problem, i.e. the simulation of cracks in the presence of an eddy-current probe of arbitrary configuration.

To do this, equations of electromagnetic field on the surface of a conductor of cylindrical shape are developed and then the FEM is applied to its solution.

The developed code has a graphical user interface and can be used for fast computation and plotting of various impedance diagrams.

Subspace iteration method for generalized singular values

A.H. Bentbib[1], A. Kanber[2], K. Lachhab[3]

[1] a.bentbib@uca.ma

[2] kanber@uca.ac.ma

[3] kamal.lachhab@ced.uca.ac.ma

Abstract

It's well known that the Singular Values Decomposition (SVD) is useful in many applications such as low rank approximation, data reductions, identification of the best approximation of the original data points using fewer dimensions. It's also a useful tool for computation of eigenvalues of matrix A^TA without explicitly forming the matrix product. The Generalized Singular Values Decomposition (GSVD) of the pair (A, B) is also a useful tool for computation of the generalized eigenvalues of the symmectric pencil $A^TA - \lambda B^TB = 0$. The generalized singular values of the pair (A, B) are nothing but the square roots of generalized eigenvalues of the symmetric eigenproblem $A^TA - \lambda B^TB = 0$. We present available methods to compute the largest generalized singular values and vectors using iterative subspace-like method. The new approach gives considerably better efficiency compared to the matlab function . Numerical examples show the effectiveness of the presented method.

Keywords: singular value, generalized singular values problem, matrix pair, power method, ...

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Metric regularity of composition multifunctions

Meriem Meddahi[1]

[1] University of Hassiba Benbouali, Departement of Mathematics, Chlef, Algeria.

Abstract

The aim of this paper is to give a metric regularity theorem for composition of set-valued mappings between metric spaces involving a new concept of composition stability.

Keywords. Set-valued mapping, Metric regularity, Composition multifunction, Composition stability.

Mathematicas Subject Classification (2000). 90C25, 49M45, 65C25.

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Implementation Techniques for Non-Symmetric Real Toeplitz Systems by Preconditioned GMRES Method

Dimitrios Noutsos[1], Grigorios Tachyridis[2]

[1,2]*Department of Mathematics, University of Ioannina, GR45110 Ioannina, GREECE*

Abstract

In this poster we show some implementation techniques of real non-symmetric and non-definite Toeplitz systems $T_n(f)x = b$ by Preconditioned Generalized Minimum Residual (PGMRES) method. Toeplitz matrices have the same entries along their diagonals and are generated from the Fourier coefficients of a 2π-periodic generating function or symbol f. Such systems appear in various Mathematical Topics: Differential and Integral equations, Mechanics, Fluid Mechanics and in Applications: signal processing, image processing and restoration, time series, and queueing networks.

We follow the results of the paper presented by Noutsos in NASCA2018 conference to show techniques of constructing efficient preconditioners, especially for illconditioned problems.

Moreover, we will present techniques of solving such systems by PGMRES method when the generating function is unknown. We propose techniques of approximating f from the entries of the Toeplitz matrix, using Fourier expansions or Rayleigh quotients. We present a procedure which estimates the points where f has roots as well as the multiplicity of them. Taking this information into account we construct efficient preconditioners.

The efficiency of the proposed techniques are shown by various numerical experiments.