PROJETO COMPUTACIONAL #4 – MS993/MT404 – 2S2016 – IMECC/UNICAMP
Matemática Aplicada

Atenção: Este projeto #4 poderá ser desenvolvido individualmente ou com no máximo 3 (três) estudantes.

Atividade	Temas(*)	Disponibilização	Entrega
Projeto #4 (**P4**) C. C. Paige and M. A. Saunders, Solution of Sparse Indefinite Systems of Linear Equations, SIAM J. Numer. Anal., 12 (4) (1975), 617-629. D.C. Fong & M. A. Saunders. CG versus MINRES: An empirical comparison. SQU Journal for Science, 17(1) (2012), 44-62 **(*)** It is advisable to consult all files available into the folder auxFilesP4.	Minimum Residual Method, Symmetric Indefinite Systems of Linear Equations, Large and Sparse Symmetric Indefinite Systems, Conjugate Gradients, Lanczos method, Iterative Solvers, Krylov methods**,** Matlab native codes; Preconditioning, Matrices and its applications at by using University of Florida Sparse Matrix Collection and Matrix Market. **(*)** You is invited to include any other key reference, up to date, on your own choice (see refs [1], [2] and [3] just below and the others into the folder auxFilesP4).	14/Out	4/Nov

[1] James H. Bramble, Joseph E. Pasciak and Apostol T. Vassilev, Uzawa Type Algorithms for Nonsymmetric Saddle Point Problems, Mathematics of Computation, 69(230) (2000) pp. 667-689.
[2] Olaf Schenk and Klaus Gärtner, On fast factorization pivoting methods for sparse symmetric indefinite systems, ETNA. Electronic Transactions on Numerical Analysis, 23, (2006) 158-179.
[3] Michele Benzi, Gene H. Golub and Joerg Liesen, Numerical solution of saddle point problems, Acta Numerica - Cambridge University Press (2005) 1-137.

The primary learning goal of the project. The core goal here (see tasks 1 and 2 in what follows) is closely related to the previous assignments, namely, Projetos #1, #2 and #3. Now we are primarily focused in the numerical solution of sparse indefinite systems of linear equations by using the Matlab native implementation of the MINRES method introduced in the paper (It is worth mentioning that MINRES is also a member of the Krylov subspace methods):

- C. C. Paige and M. A. Saunders, Solution of Sparse Indefinite Systems of Linear Equations, SIAM J. Numer. Anal., 12 (4) (1975), 617-629.

TASK 1. You should try to repeat at least 2 (two) cases of your choice from those numerical experiments treated in Project #3, along with the matrices at The University of Florida Sparse Matrix Collection (link : http://www.cise.ufl.edu/research/sparse/matrices/). You should report in details what happens as well as your findings in this study. The number of pages is free (i.e., on your choice).

TASK 2. In this topic, you should first go to The University of Florida Sparse Matrix Collection (link : http://www.cise.ufl.edu/research/sparse/matrices/) and then select at least 4 (four) matrices (**of sparse indefinite type**) from distinct physical/science/engineering aplications. Next, you must perform a comparative study, including advantages and disadvantages (theoretical, numerical and application view points) in the same good lines (mandatory) as reported in "*D.C. Fong & M. A. Saunders. CG versus MINRES: An empirical comparison. SQU Journal for Science, 17(1) (2012), 44-62*" (see auxFilesP4.zip in the site course). Indeed, it is advisable to establish connection along with the uzawa method for indefinite linear systems (see, e.g., ref[2] and ref[3]; you can find both texts into the folder auxFilesP4).

Remark. This assignment seems to be short, but is it somewhat intricate. It is expected you might enjoy even more from this numerical linear algebra course. In this project is expected more independence from all the undergraduate and graduate students. All the best for all!