On a direct solver for linear least squares problems[*]

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Abstract

The Null Space (NS) algorithm is a direct solver for linear systems of equations. It was initially designed and theoretically analyzed by M. Benzi in 1993 for square nonsingular systems, and its main idea consists on projections of an initial set of vectors onto the hyperplanes associated to the system equations, by using projections parallel with some specific directions which are constructed during the development of the algorithm. In this paper we extend and theoretically analyze the NS algorithm to linear least squares problems.

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keywords: consistent linear systems; Null Space algorithm; linear least squares problems; normal equations; augmented system

1 Introduction

For $A : m \times n$ and $b \in I\!\!R^m$ we will consider the system of linear equations

$$Ax = b. \tag{1}$$

If b is in the range of A, i.e. at least one $z \in I\!\!R^n$ exists such that $Az = b$, we say that (1) is consistent and denote by $S(A; b)$ the set of all its solutions

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