

Les 5ièmes journées montréalaises de calcul scientifique
The 5th Montreal Science Computing Days
30-04 – 02-05, 2008

Stopping Criteria for the Iterative Solution of Linear Least Squares Problems

David Titley-Peloquin
School of Computer Science
McGill University
3480 University, #318
Montréal (Québec), H3A 2A7
CANADA

`dtitle@cs.mcgill.ca`

Abstract

Given an m by n matrix A and an m -vector b , the linear least squares (LS) problem is the following: find an n -vector x which minimizes the 2-norm of the residual $b - Ax$. The LS problem has applications in numerous areas of science and engineering, such as statistics, signal processing, machine learning, geodesy and navigation.

Iterative methods for the solution of large sparse linear least squares LS problems produce a sequence of iterates x_k (for $k = 1, 2, \dots$) which hopefully converge to the true LS solution. One important question to ask when using an iterative method is when to stop the iteration, in other words for which k is the approximate solution x_k “good enough”? This is the main topic discussed in this talk.

We first define what we mean by an “acceptable LS solution”. We then show that commonly-used stopping criteria can in some situations fail to detect that an acceptable LS solution has been obtained. Finally we propose two new conditions to test if a given iterate x_k is in fact an acceptable LS solution.