

Scientific Computing HW2

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1 The Hilber Matrix

1.1 Conditioning Numbers

Fristly I compared direct calculation of condition number with the built-in exact calculation cond.

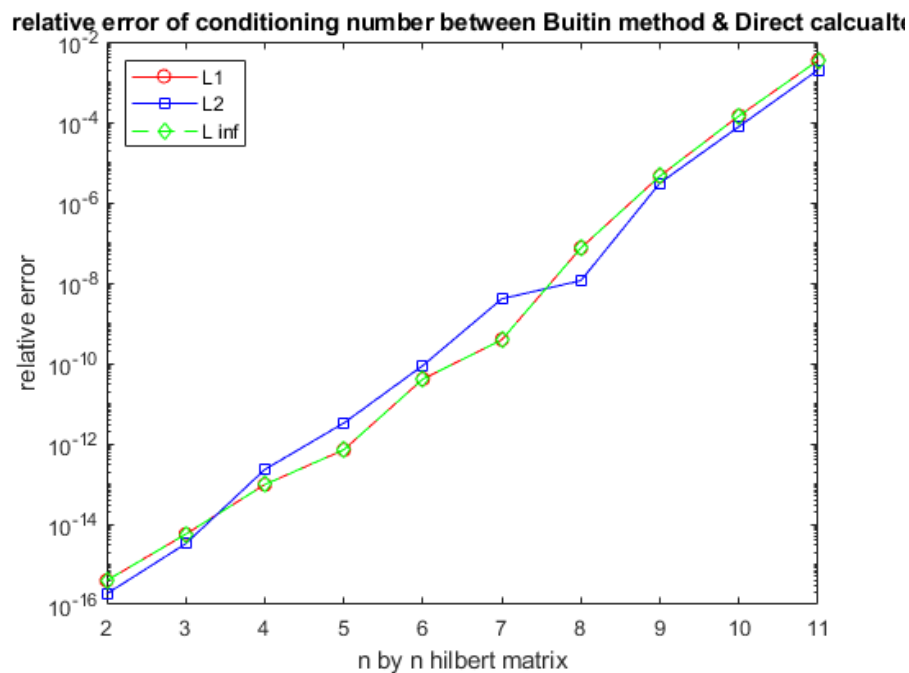


Figure 1: condition number comparison

As shown in Figure 1, the relative error of computing condition number directly increase with the size of hilbert matrix increasing. Each time the hilbert matrix size increases, we lose 2 digits of accuracy. The graph also shows that the built in function use the same calculation method with direct calculating when calculating L1 and L infinite , while it does not when calculating L2. This observation in accordance with Matlab document: when doing L2, cond method use Singular Value Decomposition to do the calculation. L2

Then I compared direct calculation of reciprocal condition number with the estimate rond number.

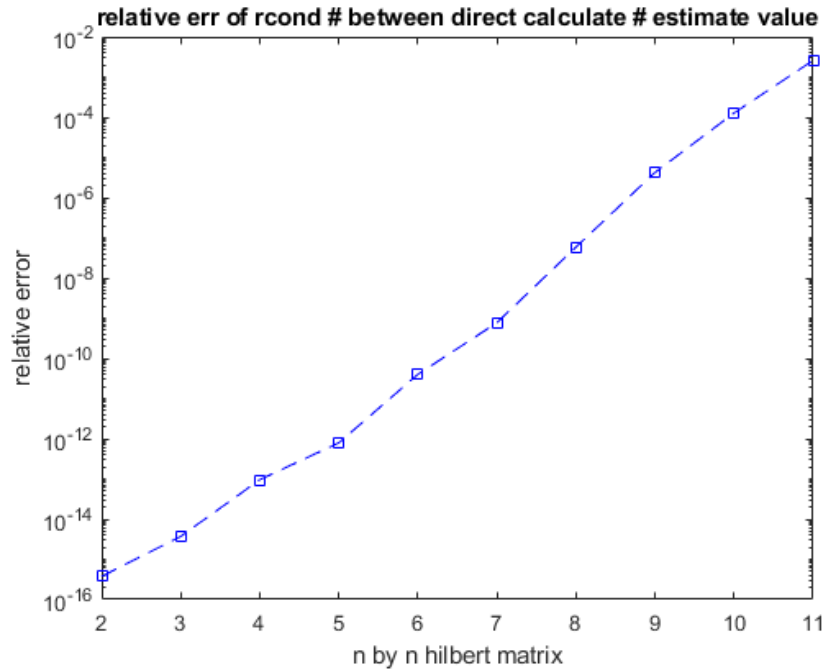


Figure 2: reciprocal condition number comparison

As shown in Figure 2, the relative error of computing reciprocal condition number increase with the size of hilbert matrix increasing. Each time the hilbert matrix size increases, we also lose 2 digits of accuracy.

1.2 Solving ill-conditioned systems

2 Different Methods

2.1 Three-method fitting

2.2 The Best Method

3 Rank-1 Matrix Updates

3.1 Direct Update

3.2 SMW Formula