**1 The Hilbert Matrix**

It is often better to use methods to find the LU factorization or QR factorizations using Householder reflections and Givens rotations because it reduces the error when solving linear systems. Other methods such as Gram-Schmidt to find the QR factorization can be troublesome because the error can be large due to a large condition number. When solving for Q you find AR1R2R3…Rn = Q; however, Cond(Ri) can be large. Using orthogonal transformations to bring A into an upper triangular form is more stable because Cond(Qi) = 1, thus the error can be significantly less than other methods when solving linear systems. If there is any error in b when you are solving a system Ax = b and you are using the inverse to solve, the error will be amplified by the largest eigenvalue of the inverse when you find the solution; however, if you use the methods for QR factorization using orthogonal transformations there will be no error amplification. Therefore it is beneficial using LU and QR-factorizations this way to reduce unneeded error when working with large systems.

Another benefit of using these methods to solve linear systems is that it can be easily solved for using backwards substitution since a part of the factorization will be a triangular matrix.

Hilbert Matrices Errors

