Scientific Computing: Homework 3

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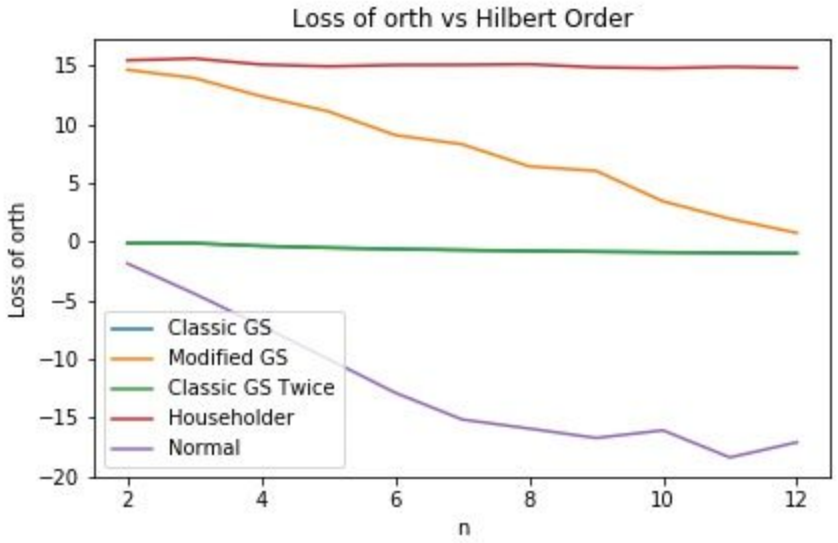
Problem 1: Errors in polynomial evaluation

(c, also a and b, combined graph)



(Classical GS is just below Classical GS Twice)

(a) The quality (departure from orthogonality) of Classical GS and Classical GS applied twice is almost the same and remains somewhat constant, while that of Modified GS is a lot higher than both Classical methods but decreases with an increase in n.

(b) Householder method performs the best for all remaining somewhat constant as n increases. While the quality (departure from orthogonality) of Classical GS and Classical GS applied twice is almost the same and remains somewhat constant, that of Modified GS is a lot higher than both Classical methods but decreases with an increase in n.

(c) Householder method performs the best for all remaining somewhat constant as n increases. While the quality (departure from orthogonality) of Classical GS and Classical GS applied twice is almost the same and remains somewhat constant, that of Modified GS is a lot higher than both Classical methods but decreases with an increase in n. Normal Equation gives the least quality starting near zero and goes down with an increase in n.

(d)

The householder method is computationally more efficient that all GS methods and normal equations, thus has less compounded error and thus is the best. Then in order Modified GS, Classical GS and Classical GS Twice come.
Normal Equations suffer even more from compounded errors.

Householder: $|| I - Q^TQ || \propto \epsilon$,
Modified GS: $|| I - Q^TQ || \propto \epsilon \times K(A)$
Classical GS: $|| I - Q^TQ || \propto \epsilon \times K(A)^2$
Classical GS Twice: $|| I - Q^TQ || \propto \epsilon \times K(A)^2 \times K(Q_1)^2$