Consider the nonlinear 1D ODE,

\[-u'' + g|u|^{p-2}u = f, \quad x \in (a, b),\]
\[u(a) = 0,\]
\[u(b) = 0.\]

In the files stored in `fd_nonlinear_1D.zip` associated to Lecture 11 it is solved using a method of successive substitutions, i.e., fixed point iteration: \(u_k \rightarrow u_{k+1}\), where \(u_{k+1}\) is a solution of the problem

\[-u''_{k+1} + g|u_k|^{p-2}u_{k+1} = f, \quad x \in (a, b),\]
\[u_k(a) = 0,\]
\[u_k(b) = 0.\]

- Implement the Andersson acceleration (GR Pulay in my Diploma Thesis) with different values of \(m\) (amount of previous iterates considered) and compare the convergence. Solve the related least-squares problem using Matlab’s QR-decomposition function `qr`.
- Try different expressions (satisfying the boundary conditions) for the exact solution \(u\), and problem data \(g\) and \(p\).