

**Alzahrani, Ebraheem O.; Al-Aidarous, Eman S.; Younas, Arshad M. M.; Ahmad, Fayyaz; Ahmad, Shamsad; Ahmad, Shahid**

**A higher order frozen Jacobian iterative method for solving Hamilton-Jacobi equations.**

(English) [Zbl 1379.65080](#)

*J. Nonlinear Sci. Appl.* 9, No. 12, 6210-6227 (2016).

**Summary:** It is well-known that the solution of Hamilton-Jacobi equation may have singularity i.e., the solution is non-smooth or nearly non-smooth. We construct a frozen Jacobian multi-step iterative method for solving Hamilton-Jacobi equation under the assumption that the solution is nearly singular. The frozen Jacobian iterative methods are computationally very efficient because a single instance of the iterative method uses a single inversion (in the scene of LU factorization) of the frozen Jacobian. The multi-step part enhances the convergence order by solving lower and upper triangular systems. The convergence order of our proposed iterative method is  $3(m - 1)$  for  $m \geq 3$ . For attaining good numerical accuracy in the solution, we use Chebyshev pseudo-spectral collocation method. Some Hamilton-Jacobi equations are solved, and numerically obtained results show high accuracy.

**MSC:**

**65M70** Spectral, collocation and related methods for initial value and initial-boundary value problems involving PDEs

**35F21** Hamilton-Jacobi equations

**65M12** Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs

**Keywords:**

Hamilton-Jacobi equations; frozen Jacobian iterative methods; systems of nonlinear equations; Chebyshev pseudo-spectral collocation method; numerical example; convergence

**Full Text:** [DOI](#) [Link](#)