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This paper is concerned with the global well-posedness of highly regular solutions and the exponential stabilization of the total energy with respect to the H^2 -norm for a Cauchy-Dirichlet problem arising from Burgers' equation with nonlocal viscosity in both bounded and unbounded domains. For numerical experiments, we consider the one-dimensional Burgers' equation defined in an unbounded domain. In order to perform the computations on a finite interval, a sequence of expanding artificial boundaries is introduced, following the same approach used in the theoretical analysis to prove the existence of solutions. The numerical approximations are obtained using a linearized Crank–Nicolson–Galerkin scheme, employing Hermite polynomials as basis functions. The computational results validate the theoretical analysis and demonstrate consistency with the predicted behavior. In addition, tables are provided to illustrate the convergence rates and exponential decay of the energy.

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