Strong solution to the multidimensional stochastic Burgers equation

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We prove the existence and uniqueness of a global strong adapted solution to the multidimensional stochastic Burgers equation

$$y(t,x) = h(x) + \int_0^t [\nu \Delta y(s,x) - (y,\nabla) y(s,x) + f(s,x,y)]\, ds + \int_0^t g(s,x)\, dB_s$$

in the space $\mathrm{C}([0,T]\times \mathbf{R}^n)$ without gradient-type assumptions on the force or the initial condition. The solution is C^2 in $x \in \mathbf{R}^n$ and α-Hölder continuous in $t \in [0,T]$ for some $\alpha < \frac{1}{2}$. Our approach is based on an interplay between forward-backward SDEs and PDEs. Moreover, we show that as the viscosity goes to zero, the solution of the viscous stochastic Burgers equation converges uniformly to the local strong adapted solution of the inviscid stochastic Burgers equation.