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A Fast Explicit Operator Splitting Method for Modified Buckley-Leverett Equations.

In this talk, I will discuss a fast explicit operator splitting method to solve the modified Buckley-Leverett equations which include a third-order mixed derivatives term resulting from the dynamic effects in the pressure difference between the two phases. The method splits the original equation into two equations, one with a nonlinear convective term and the other one with high-order linear terms so that appropriate numerical methods can be applied to each of the split equations: The high-order linear equation is numerically solved using a pseudo-spectral method, while the nonlinear convective equation is integrated using the Godunov-type central-upwind scheme. A variety of numerical examples in both one and two space dimensions show that the solutions may have many different saturation profiles depending on the initial conditions, diffusion parameter, and the third-order mixed derivatives parameter. The results are consistent with the study of traveling wave solutions and their bifurcation diagrams. This is a joint work with C.-Y. Kao, A. Kurganov, and Z.-L. Qu. (Received February 18, 2015)