1154-65-1705 **Shuang Liu*** (shuang@email.sc.edu), 1523 Greene Street, Department of Mathematics, University of South Carolina, Columbia, SC 29208, and **Xinfeng Liu** (xfliu@math.sc.edu), 1523 Greene Street, Department of Mathematics, University of South Carolina, Columbia, SC 29208. *A level-set method combing explicit exponential time differencing scheme (eETD) with adaptive Krylov subspace for a class of stiff reaction-diffusion system with free boundary.* Preliminary report.

The spreading of new or invasive species is a central topic in ecology. The systems of reaction-diffusion equations coupled with free boundary defined by Stefan condition have been widely used to better understand the nature of spreading behaviors of new species. From mathematical modeling point of view, it is a challenge to perform numerical simulations of the free boundary problems, due to the moving boundaries, the topological changes and the stiffness of the system.

In our work, we have incorporated explicit exponential time differencing method (eETD) with adaptive Krylov subspace and level set method to solve reaction-diffusion equations with free boundary in 2D. We introduce three different temporal schemes: Runge-Kutta, Crank-Nicolson and explicit ETD scheme with adaptive Krylov subspace for handling such stiff systems. Numerical examples are examined to illustrate the efficiency, accuracy and consistency for different approaches, and it can be shown that adaptive Krylov eETD is superior to other approaches in terms of stability and efficiency by direct comparison. (Received September 16, 2019)