**Konstantinos Zygalakis**
Mathematical Institute, University of Oxford
e-mail: zygalakis@maths.ox.ac.uk
**K. Burrage**
Computing Laboratory, University of Oxford
**B. Melykuti**
Department of Mechanical Engineering, University of California, Santa Barbara

## Alternative formulations of the Chemical Langevin Equation

The Chemical Langevin Equation is a Stochastic Differential Equation that describes the time evolution of molecular counts of reacting chemical species D. Gillespie, Journal of Chemical Physics, 113(1), pp 297-306 (2000)). It stands as a bridge between the deterministic ODE model and the discrete probabilistic chemical Master equation.

Suppose n chemical species react through m reaction channels, and the n x m stoichiometry matrix is denoted by S. Gillespie formulated the CLE with m independent standard Brownian motions. In this talk we describe an alternative formulation of the CLE which in general leads to a SDE with a smaller number of Brownian motions. For example if r is the number of pairs of reversible reactions, then in Gillespie's formulation there would be 2r Brownian motions for the reversible reactions, while in our formulation there would only be r. We illustrate that such a reaction leads to significant computational savings.