1105-65-210 **John P Roop*** (jproop@yahoo.com), Department of Mathematics, 1601 E. Market St., Greensboro, NC 27411. *Anomalous Nonlocal Generalizations of the Reaction Diffusion Equation: Analysis and Computation.* Preliminary report.

In this talk, we review several anomalous and nonlocal generalizations of the reaction diffusion equation $u_t - \nabla \cdot (\kappa \nabla u) = f(u)$. Numerical solutions to the reaction diffusion equation serve as a starting point for student research projects because a discretizations are straightforward, the equations are widely applicable, several papers have been written on the various mathematical properties, and generalizations can model anomalous diffusion and nonlocal reaction phenomena. First, the diffusion term may be generalized using a more generic anisotropic diffusion $\nabla \cdot (\kappa(|\nabla u|)\nabla u)$ used in for example image processing, the p-Laplacian, or diffusion driven instability. In addition, the diffusion term may be generalized using a fractional order diffusion operator of which several forms exist, e.g. $\nabla \cdot (\kappa \mathcal{D}^{-\beta} \nabla u)$, a fractional order integral, or $\kappa \int_{B_\epsilon} |x - \xi|^{-\alpha}(u(x) - u(\xi))d\xi$, a nonlocal fractional order convolution operator. Finally, a reaction term will satisfy the traditional analysis when it is an "operator of order zero." One generalization is when the reaction operator takes the form $\nabla \cdot (u\, B(u))$. (Received September 20, 2014)