LNKSc Method on PDE-Constrained Optimization for MCF-7 breast cancer cell growth predictions and treatment response with Gold Nanoparticles

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The presentation discusses about the implementations of Lagrange Newton Krylov Schur (LNKSc) Method on Partial Differential Equation (PDE)-Constrained Optimization for cancer growth predictions and treatment responses. We explore the applications of the LNKSc method to find the best fit mathematical model for the data from the undergraduate research in Biology Laboratory at Jarvis Christian University, Hawkins, Texas. The research used in vitro experiments by inducing Gold Nanoparticles on the MCF-7 breast cancer cells and studied the effects of the particles on the cancer cell growth predictions and treatment responses. To find the best fit model, we set up the problem as a constrained optimization problem, where the objective function is the misfit errors between the data and the state variable and the constraint is the model (PDE) with the unknown designed variables (parameters), or a PDE-constrained optimization problem. To solve the optimization problem, we set up the problem as an unconstrained optimization problem by adding the PDE constraint with a Lagrangian multiplier to the objective function. Then, we solve the PDE-constrained optimization by using the LNKSc method.

Keywords: PDE, optimization, Lagrangian multiplier, in vitro experiment, LNKSc, MCF-7, Nanoparticles