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Karlstad Applied Analysis Seminar (2021)

Meraj Alam, Mahindra University, India.

August 24, Wednesday, 10:00

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We propose a macroscopic mathematical model that describes hydrodynamics and deformation mechanics within a solid tumor which is embedded in or adjacent to a healthy (normal) tissue. The tumor and normal tissue regions are assumed to be deformable and the theory of mixtures is adapted to mass and momentum balance equations for uid ow and tissue deformation mechanics in each region. The momentum balance equations are coupled via forces that interact between the phases (uid and solid). Continuity of normal velocities, displacements, and normal stresses along with the Beaver-Joseph-Sa man condition are imposed at the interface between the tumor and tissue regions. The physiological transport parameters (such as hydraulic resistivity or permeability) are assumed to be heterogeneous and deformation dependent which makes the model nonlinear. Based on the structure of hydraulic resistivity, we analyze linear and nonlinear cases separately. In the case of linear problem, we derive a priori estimates on the solution and establish the existence of a weak solution using Galerkin method supported by convergence methods. We show further that the solution depends continuously on the given data. The existence, uniqueness results obtained from the linear problem are extended to the corresponding nonlinear problem. An iterative procedure is used in order to show the existence in case of the nonlinear problem.