CAHN-HILLIARD-DARCY MODELS FOR TUMOUR GROWTH AND RELATED FREE BOUNDARY PROBLEMS

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In recent years several phase field type models for tumour growth have been introduced. We propose a new model which is derived with the help of basic thermodynamical principles and leads to a Cahn-Hilliard-Darcy system. The model takes nutrient diffusion, chemotaxis, apoptosis, proliferation, adhesion and as a new aspect active transport into account. An additional new feature of the model is that it is based on a volume averaged velocity which leads to particular simple equations for the flow velocity and the pressure. Sharp interface limits leading to free boundary problems are identified. Well-posedness results for the full Cahn-Hilliard-Darcy system are studied. Finally, we also introduce generalizations to multi-phase situations, present numerical simulations and discuss possible optimal control problems.