# Abstract

Inthepresentthesis,somecancermathematicalmodelsdescribed bydifferential equations,aswellassomegeneralizedmathematicalmodelsdescribedbyfractional differentialequationsthattakeintoconsiderationthememoryeffectsofthetumor growthprocessarestudied.

Theanalyticalandnumericalsolutionsofthestudiedproblemsaredeterminedby couplingtheclassicalmethodsinordinary/partialdifferentialequationswiththein-tegraltransformsmethod. Fourmainproblemsareinvestigated,namely: - Ageneralizedmathematicalmodelofbreastcancerandovariancancer.Thedevel-opedmodelisbasedonthetime-fractionalCaputoderivativeoperatorandonthe Riemann-Liouvillefractionalintegraloperator. - Atime-fractionaldiffusivemathematicalmodelofcancertumors thattakesinto considerationthehistoryoftumorcellconcentrationfortwocasesofthekillingrate ofcancercells. - Generalizedmathematicalmodelsofcancerwithapower-lawkernel ofmemoryand constantkillingrateofcancercells,forcylindricaldomains. - Thegeneralizedcancermathematicalmodel,describedbyafractionaldiffusion equation,withthekillingrateafunctionofthetumorcellconcentration. Solutionsofthefractionaldifferentialequationsofthestudiedmathematicalmodels ofcancer,alongwiththeadequateinitialandboundaryconditionsaredetermined byemployingtheLaplacetransform,finiteHankeltransform,and similaritytrans-formationsobtainedfromtheLiegroupofsymmetries. 56 Using the analytical/numerical solutions and Mathcad 15 subroutines, the numerical and graphical analysis of the tumor cell concentration is presented. The analysis shows that the memory parameter (the fractional order of the time derivative) has a significant influence on the tumor cell concentration; therefore the generalized cancer models could better describe complex cancer evolution.