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SOME PROBLEMS OF POROELASTICITY

We propose to investigate the following problems and to develop efficient numerical processes for their solution:

1. Mathematical Problems of Poroelasticity (MPP): Modeling, Analysis.

1.1. The creation and justification of spatial nonlinear mathematical model for thermo-dynamic magneto-poroelastic media and analysis and comparisons with known theories.

1.2. The creation and justification of mathematical models for poroelastic plates and shallow shells having physical soundness. New physical layered effects explaining paradoxes peculiar to refined theories of plates in isotropic elastic case will be investigated.

1.3. The creation and justification nonlinear mathematical models for poroelastic beams with variable cross section. Construct and investigation of refined (in von Karman–Reissner sense) theories for elastic beams.

2. MPP: Investigations of some systems of nonlinear DE-s with averaged initial and boundary conditions corresponding to one and two dimensional (with respect to spatial coordinates) mathematical models for beams and plates.

2.1. The applications of generalized analytical functions nonlinear theory to two-dimensional mathematical models for poroelastic plates and shallow shells.

2.2. The development of nonlinear Volterra kind second type system and its application to some mathematical models for poroelastic beams.

3. MPP: Elaboration of numerical algorithms, creation of software and design of some practical objects.

In this part we consider only two-dimensional mathematical models of poroelasticity. Below D(x,y) denotes the connected domain:

3.1. If D represents a classical domain as circle, semicircle, ellipse, whole plane, first we prefer to use results of Analytical and Generalized Analytical Functions Theory and Potential Methods, constructing the nonlinear systems of integro-differential equations. Development of new numerical schemes.

3.2. If D represents a technical domain as curvilinear triangle, rectangle, trapezium, quarter of plane, then we prefer to use the schemes representing some modifications of our previously works.

The methods developing for investigations of corresponding problems represent nonlinear systems of integro-differential equations. Applications of BE or FE methods or Projective methods (using the apparatus of one or two variable orthogonal functions theory for rectangle or triangle regions) give also the new schemes for design.