CONSTITUTIVE DISTRIBUTED PARAMETER MODELLING OF MOVING COORDINATE SYSTEMS (PART II)

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We concentrate our attention on the analytical solution of the deduced in Part I system of the partial differential constitutive state equations (I) from the point of view of the control theory [1]. For the realization of the constitutive distributed parameter control by the use of the physical phenomena of the multicomponent and multiactive media we need to obtain [1–7]:

- analytical solution of the system (I) by presence of the initial and boundary conditions,
- complete information for the phenomenally distributed parameter control,
- structure of the phenomenally distributed parameter control,
- optimization problems for the single physical phenomenon and whole system (I),
- an adaptive control concept.

Analytical Solution of the System (I) by Presence of the Initial and Boundary Conditions

The source elements for the system (I):
Initial conditions

\( C_0, T_0, \psi_0 \quad C_{\psi 0}, T_{\psi 0}, \psi_{\psi 0} \)

The analysis of the homogeneous part of the system (I):

Introducing definition of the rotational field: exists \( \mathbf{B} \) vector potential of the fluid field so that \( \nabla = \text{rot} \mathbf{B} \) and \( \text{div rot} \mathbf{B} \equiv 0 \) \([8-9]\) and from the idealization of the media \([10]\) we have,

for the potential fields

\[
\frac{\partial C}{\partial t} = D_c \nabla^2 C \quad (1) \quad \frac{\partial T}{\partial t} = \frac{\lambda_c}{c_p} \nabla^2 T \quad (2) \quad \frac{\partial \psi}{\partial t} = \sum_{i=1}^{f} \frac{H_{ci}}{c_p} D_{ci} \nabla^2 \psi_c \quad (3)
\]

\[
\frac{D}{Dt} = \frac{\partial}{\partial t} \pm \nabla \text{grad} \] ·

In accordance with above the general formula governing the solutions of the phenom­

enal partial differential equations of the potential fields and the rotational field is:

\[
W_{PH}(Z, t) = \int_0^t \int_0^{\Omega R} \int_0^{E_R} \int_0^{E_R} \int_0^{E_R} G_{P_R}(P, t; Q^R, \tau) \left( \frac{d^*}{d^*} \right) d\Omega_R(Q^R) d\tau + \int_0^t \int_0^{\Omega R} \int_0^{E_R} \int_0^{E_R} G_{P_R}(P, t; Q^R, \tau) dE_R \left( \frac{d^*}{d^*} \right) + \int_0^t \int_0^{\Omega R} \int_0^{E_R} \int_0^{E_R} G_{P_R}(P, t; Q^R, \tau) dE_R \left( \frac{d^*}{d^*} \right) + \int_0^t \int_0^{\Omega R} \int_0^{E_R} \int_0^{E_R} G_{P_R}(P, t; Q^R, \tau) dE_R \left( \frac{d^*}{d^*} \right) \left( \frac{d^*}{d^*} \right) \quad (S.1)
\]

Complete solution of the system (I) by presence of the initial and boundary conditions fulfils the general formula: