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Editoria

This journal is edited by the Systems Research Institute of the Polish Academy of Sciences. Its main objective is to stimulate the development of cybernetical and systems sciences through publication of papers by authors from the Institute as well as from Poland and abroad.

The field of interest covers general concepts, theories, methods and techniques associated with control and management in various systems (e.g. technological, economical, ecological, social).

The journal is particulalry interested in results in the following areas of research:

Systems and control theory
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Systems control and management
- System analysis of national and regional development
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- Methodological aspects of applications of control and systems methods

We hope that Control and Cybernetics will contribute to the development of systems and control sciences and will stimulate and encourage applications of systems approach in different areas.

The following issue of Control and Cybernetics will appear as No. 1-3, Vol. 14, 1985. It will be devoted to "Recent advances in free boundary problems" and guest edited by M. Niezgódka and I. Pawłow.

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A model problem of the theory of non electrolyte transfer through deformable semipermeable membranes

by

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The theory of the convective-diffusion mass transfer through deformable semipermeable membranes not resisting deformations, as it is presented in author's paper [9], [10], needs studying its mathematical aspects. The paper deals with a model problem of this theory formulated for its one--dimensional version. Fields of concentrations, velocities of the solution motion along compartments divided by the membrane, and the shape of the latter are subjects of the solution of a boundary value problem formulated for a system of two non-linear parabolic equations of the second order, one non-linear hyperbolic equation of the first order and two ordinary differential equations of the first order with relevant boundary and initial conditions. The local existence and uniqueness theorem is proved by means of reducing the problem to a system of Volterra integral equations with the use of certain contraction mapping arguments.

1. Introduction

In what follows we consider a plane cell

$$D=\{x, y: 0<x<1;\ 0<y<A\} \tag{1.1}$$

divided by the line $y=y(x, t)$ into two regions

$$D_1=\{x, y: 0<x<1;\ y(x, t)<y<A\};\ D_2=D\setminus\bar{D}_1 \tag{1.2}$$

where $A=\text{const}>0$ is assumed to be much smaller than 1.

Boundaries $(x=0;\ 0<y<A)$ and $(x=1;\ 0<y<1)$ are called below the basal and the apical membranes; the line $y=y(x, t)$ — the lateral one. We assume that the cell D is filled with water solution of a certain non-electrolyte which cannot penetrate through all aforementioned membranes as well as through the boundaries $(0<x<1;\ y=0)$ and $(0<x<1;\ y=A)$. These boundaries, as well as parts $(x=0;\ 0<y<y(x, t))$ and $(x=0;\ y(x, t)<y<A)$ of the basal and apical membranes are impermeable for water too. Hence the lateral membrane is a main passway for the water transfer, originated by the immersion of the cell D into water solution of the same impermeant, hypertonic/hypotonic on the basal and hypotonic/hypertonic