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for the velocity are supposed. The unicity of the weak solution for the velocity is proved for a limited set of values of physical parameters.

Nonconforming finite elements are used for the discrete approximation of the space $\vec{W}^{1,3}(\Omega)$. The sufficient condition of discrete coercivity is derived. The existence of a discrete velocity is proved under conditions which are analogous to unicity conditions of the weak solution. The unicity of discrete pressure except for an addition of a constant is proved.

The usual numerical methods are used for the practical computation of some simple cases.

SPECIAL CURVED ELEMENTS AND THEIR APPLICATION

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Special curved elements are constructed in the submitted thesis. Further they are used to the definition of the interpolation functions and the application to the solution of contact problems by means of the finite elements method is shown.

In Chapter I the mapping F which maps a rectangle onto a triangle is defined and its main properties are proved. In Chapter II conditions laid upon the triangulation of the domain Ω are formulated and some preliminary estimates are proved. The definitions of interpolation functions of two types are contained in Chapter III. The estimates of $\|f - \varphi\|$, φ is the interpolation function associated to f, are proved in the following chapter. These estimates are used to prove convergence of the finite elements method in the case of second order homogenous boundary value problems with $\mathring{W}_2^{(1)}$ – elliptic bilinear form.

In Chapter V the finite elements method is applied to the solution of the equivalent barotropic vorticity equation. In the last chapter the same method is used to solve electro–magnetic field in the plane.

CONSULTATION SYSTEM FOR INSULINOTHERAPY OF DIABETES MELLITUS

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The self–learning system to propose insulin therapy was developed. It is supposed to be used as a consultation system to assist the physician's decision making. The mathematical model of insulin pharmacodynamics is the main part of the system. All conventional injection therapy schemes including insulin pump treatment are supported. The parameters of the model are learned continuously during the therapy process. The methods of linear regression analysis modified with heuristic rules are used to perform the adaptation. The system proposes suitable therapy according to the individualized model. Generally, it is a combinatorical problem

to find such an optimum therapy. The simulated annealing algorithm was implemented to solve this task and to enable the system to be used in an interactive way. This part of the system also offers therapy proposals when current therapy scheme is changed. The dialogue is based on an user–friendly communication subsystem, whose description is included. The system is implemented in Turbo Pascal language on personal computer. The learning abilities off the system were tested. The system is able to predict blood sugar value with precision of 2.5 mmol/l after 3 days and 6 days of insulin pump therapy and conventional injection therapy respectively. Nowadays, the system is tested to evaluate its performation in a more detailed way from the medical point of view.

LATIN SQUARES AND PARTIAL GROUPOIDS

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(27.9.1989, supervisor K.Drbohlav)

The thesis is devoted to the study of the (so called) couples of companions. A couple of companion K is such a partial algebra $K = K(\circ, *)$ that $K(\circ)$ and $K(*)$ are cancellative groupoids, $a \circ b$ is defined iff $a * b$ is defined and for any $a, b \in K$ there exist $c, d, e, f \in K$, $c \neq b \neq d$, $e \neq a \neq f$ with $a * b = a \circ c = e \circ b$ and $a \circ b = a * d = f * d$. Couples of companions may be obtained in a natural way from pairs of qausigroups with the same underlying set and they are studied in connection with some open questions of the quasigroup theory (see [1]).

A general structural theory of couples of companions is developed using several types of amalgamation–like constructions. The geometrical notion of planarity is shown to be of central meaning here and some equations quantifying "non–planarity" of a couple are presented.

The constructions may be used to produce an algorithm generating all couples of companions of a given order.

References

[1] A. Drápal, T. Kepka, *Group modifications of some partial groupoids*, Annals Discr. Math. 18 (1983), 319–322.

ASSOCIATIVE RINGS AND THE WHITEHEAD PROPERTY OF MODULES

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In chapter 1, the notion of an orthogonal theory is studied. This notion generalizes the well–known notions of a torsion theory and a cotorsion theory, respectively (Dickson, Salce). It is proved that there is a canonical embedding of the upper semilattice of all orthogonal theories of the Tor^R bifunctor into the lower semilattice of all orthogonal theories of the Ext^R bifunctor.

The author introduces the notion of a $\otimes$–ring ($\otimes$ is the tensor product bifunctor). He proves that if R is a (von Neumann) regular ring of cardinality $\leq \aleph_0$ or a certain