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The solution of some max-separable optimization problems [Abstract of thesis]

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vector bundles arising in differential geometry of the second order are introduced axiomatically, and their basic properties are deduced. Further, an algebraic definition of a double linear connection is formulated and an equivalent characterization via flows and lifting of vector fields is given. Finally, special connections on soldered double vector spaces are investigated and a new way of finding all natural transformations of the second tangent functor  $\Pi$  into itself and the functor  $\Pi^*$  into itself is established.

#### SHORTENING OF THE UNIVERSAL CLASS IN THE ALTERNATIVE SET THEORY

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In the present thesis, problems of shortening the universal class in the alternative set theory are investigated.

The result of the first part is the confirmation P. Vopěnka's hypothesis on the possibility to interpret the alternative set theory in a theory, in the axiomatic system of which there is no scheme of induction axioms and satisfying the condition that in those of its axioms which need the existence of sets (except some variant of the axiom of prolongation), this existence has an operational character.

New facts are presented in the second part, obtained by means of using the procedures which led to the shortening of the universal class in the first part of the work.

Here we have formulated and proved a theorem on existence of  $\mathcal{A}$ -universa of specific properties and its consequence, namely a dualization of the Levenheim-Skolem guaranteeing the existence of  $\mathcal{A}$ -model for an arbitrary first order theory having a countable model. (Under  $\mathcal{A}$ -model we understand a model with the following properties: First, the universe of the model is the intersection of a countable class of sets, and secondly, any relation and any function of this model appear to be an intersection of its universe with some set.)

The use of the method of shortening of the universal class in the area of the  $\Delta_0$ -endomorphism (a generalization of an endomorphism) leads to a construction of a model of Peano axiom system. The second part of the thesis ends by its description.

#### THE SOLUTION OF SOME MAX-SEPARABLE OPTIMIZATION PROBLEMS

Amer F. JAJOU, Iraq (8.10. 1876, supervisor K. Zimmermann)

Max- (min) separable optimization problems have found a considerable interest in the literature, both theoretically and practically; such problems have been studied extensively, e.g. by Butkovič and Hevery, Cunninghame-Green, and Zimmermann.

The aim of this work is to derive some threshold type algorithms to solve some special cases of certain max-separable optimization problem of general form

$$(1) f(x) = \max_{j \in n} f_j(x_j) \rightarrow \min(\max); \max_{j \in m} r_{ij}(x_j) : b_i, i \in s; k_j \leq x_j \leq K_j, j \in n$$

where: stands for any of the relations =,  $\leq$ ,  $\geq$ .  $f_j$ ,  $r_{ij}$  are continuous functions on  $[k_j, K_j]$ ,  $k_j$ ,  $K_j$ ,  $b_i$  are given real numbers.

We state some geometrical properties of the set of all feasible solutions

of (1) and we show how this set will be extremely convex under some conditions satisfied by  $r_{ij}, f_j$ .

We derived some threshold algorithms to solve (1). Also, we considered a modified optimization problem from (1), which is a generalization of the problem considered in K. Zimmermann (Mat. Progr. Study 22(1984)). In this problem, the objective function is of the form  $f(b) = \max_{i \in S} f_i(b_i)$ . We wrote some computer programs to solve these problems.

Also, we consider a parametric optimization problem of the form (1), where the R.H.S. of the  $i$ -th constraint depend on the parameter  $t_j, t_i \in (-\infty, \infty)$ .