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On a class of torsionfree Abelian groups [Abstract of thesis]

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ABSTRACTS OF CSc. (Candidatus Scientiarum) THESES IN MATHEMATICS defended recently at Charles University, Prague

THE COERCIVITY OF ELLIPTIC SESQUILINEAR FORMS ON THE SOBOLEV SPACES $[W_2^{(s)}(\Omega)]^M$

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In the presented work, the coercivity of elliptic bilinear forms is investigated on Sobolev spaces $[W_2^{(k-\theta)}(\Omega)]^M$ and $[W_2^{(k+\theta)}(\Omega)]^M$ ($|\theta| < \frac{1}{2}$) which correspond to the system of linear partial differential equations of the second order.

The bilinear form is uniformly elliptic and the coefficients fulfil some conditions of smoothness. Ω is a domain with Lipschitzian boundary. Under these assumptions it was shown, based upon the Lax-Milgram lemma, that the solution to the Dirichlet boundary value problem exists and is unique.

The work generalizes results proved in the work J. Nečas: Sur la coercivité des formes sesquilinéaires elliptiques, Rev. Math. Pures Appl. 9(1964), 47-69.

GENERALIZED L-SPLINES AND THE MULTI-POINT BOUNDARY VALUE PROBLEM

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In the dissertation, the problem of existence and convergence of splines is investigated. There are defined L_{\wedge} -splines which are a generalization of

L-splines with mixed boundary conditions. The word mixed means a linear combination of the values of the function and its derivatives at various points.

As a tool of investigation of the spline interpolation, the theory of N-point splines is used. The problem has been defined in such a way that the results may be used for the broadest classes of splines.

The realization method is as follows:

- and analysis of N-point problem by transforming it to a two-point boundary value problem for a system of linear differential equations;
- an exact answer was given to the question when the N-point problem is self-adjoint;
- simply verifiable conditions ensuring the existence and uniqueness of the solution, i.e. L_{\wedge} -splines, were found.

The results are applied to some technical examples.

We have shown that classical splines of an odd degree and L-splines are special cases of L_{\wedge} -splines defined in this work.

The results may also be applied to other multi-point boundary value problems.

ON A CLASS OF TORSIONFREE ABELIAN GROUPS

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The class of all purely finitely generated torsionfree Abelian groups was intensively studied in the last ten years (Butler groups). In the paper

of L. Bican (Czech. Math. J. 25(100),1975, 71-75) it was shown that the group G of a finite rank is a Butler group, if and only if there exists a decomposition $\pi = \pi_1 \cup \pi_2 \cup \dots \cup \pi_n$ of the set of all primes π such that $G \otimes Z_{\pi_j}$ is completely decomposable with ordered type set $T(G \otimes Z_{\pi_j})$ for all $j \in \{1, 2, \dots, n\}$.

Thus it is natural to investigate the class \mathcal{M} of all torsionfree groups G of arbitrary rank, having the following property: there exists a decomposition $\pi = \pi_1 \cup \pi_2 \cup \dots \cup \pi_n$ such that $G \otimes Z_{\pi_j}$ is completely decomposable group with ordered type set $T(G \otimes Z_{\pi_j})$ for all $j \in \{1, 2, \dots, n\}$.

The question whether the class \mathcal{M} is closed under pure subgroups is solved negatively.

In the second part of the presented work some necessary and sufficient conditions are given, under which every pure subgroup S of a group $G \in \mathcal{M}$ lies in \mathcal{M} . With respect to the definition of the class \mathcal{M} , this means that there is a decomposition of the set π having the above properties. Concerning the length of this decomposition, an estimation in Theorem 3 is given, depending on the type (n, ℓ) of G , only. At the end of the second part it is shown that this estimation cannot be improved.

The third paragraph is devoted to the study of the closedness of the class \mathcal{M} with respect to regular subgroups. The group G_5 from Example 5 has the property that all its pure subgroups are in \mathcal{M} ; but this is not true for all regular subgroups of G_5 . The main result of the third paragraph is Theorem 7 which gives some necessary and sufficient conditions under which every regular subgroup of a group $G \in \mathcal{M}$ belongs to \mathcal{M} .

NETS SATISFYING THE QUADRANGLE CONDITION

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In the present work nets satisfying the following condition of closedness of quadrangle are investigated: If any four points of a net no three of them lying on a line can be joined by five lines, there exists uniquely defined sixth line which also joins these points. The nets satisfying such a condition are called Q-nets. The work consists of four parts. The first part contains basic definitions and theorems. In the second part it is proved that every Q-net is an Ostrom net and every Ostrom net is a Q-net. In the third part there are studied some stronger closedness conditions which follow from the quadrangle condition, such that some parallelism of sides or some sides and diagonals are needed. In the fourth part it is proved that any Ostrom net over a Galois field can be embedded into a desarguesian plane. Further a classification of quadrangles in Ostrom net and a formula for number of such quadrangles are presented.

NUMERICAL SOLUTION OF CASCADE FLOWS BY FINITE ELEMENT METHOD

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The thesis is devoted to the mathematical and numerical study of a quasi-stationary, incompressible or subsonic compressible, irrotational, non-viscous cascade flows in a layer of variable thickness. It represents the gene-