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

The question whether the class $\mathfrak{M}$ 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 $G\in\mathfrak{M}$ lies in $\mathfrak{M}$. With respect to the definition of the class $\mathfrak{M}$, 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 $\mathfrak{M}$ with respect to regular subgroups. The group G_5 from Example 5 has the property that all its pure subgroups are in $\mathfrak{M}$; 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 $G\in\mathfrak{M}$ belongs to $\mathfrak{M}$.

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 generalization of the results contained in the paper of M. Feistauer (Appl. Mat. 29(1984), 423-458) for rotating blade rows.

On the basis of the continuity equation, condition of irrotational flow and the equation for density we use stream function formulation. The nonlinear equation for ψ

$$\sum_{i=1}^{2} \frac{\partial}{\partial x_i} \left(b(x_1,x_2,(\nabla\psi)^2) \frac{\partial\psi}{\partial x_i}\right) = \omega \frac{\partial r^2}{\partial x_1}(x_1) \quad (\omega = \text{const.})$$

is investigated in the periodic domain Ω. The function b denotes the term $1/h\rho$, where ρ is the density of the fluid and the functions r, h characterize the geometry of the layer of variable thickness. In the incompressible case ρ is constant and b is the function of x_1 only. If the fluid is compressible, the density ρ is an implicit function of x_1, x_2 and $(\nabla\psi)^2$:

$$\rho = \rho_0 \left[1 + \frac{\varkappa-1}{2a_0^2}\omega^2 r^2 - \frac{\varkappa-1}{2a_0^2}(rh\rho)^{-2}(\nabla\psi)^2\right]^{1/(\varkappa-1)}$$

In order to express ρ uniquely, we assume that the flow is subsonic. So we get the coefficient $b(x_1,x_2,(\nabla\psi)^2(x_1,x_2))$.

We consider the boundary conditions of several types. We can choose some suitable combinations of Dirichlet, Neumann, incomplete Dirichlet, periodic or trailing conditions.

The problem is formulated variationally. The existence and uniqueness of the solution and the properties of its finite element approximation are studied. The convergence of the finite element method is proved and some aspects of algorithmization are explained. Special attention is paid to iterative processes for the calculation of the approximate solution. Results of calculated flow fields are presented (including the comparison with the integral equation method).

SPECTRAL ANALYSIS OF VARIATIONAL INEQUALITIES

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This dissertation is concerned with the existence of eigenvalues and bifurcation points of variational inequalities and with the solvability of the inequality

(1) $\quad u \in K: \quad \langle \lambda u - Au - f, v - u \rangle \geq 0 \quad \forall v \in K,$

where K is a convex cone in a Hilbert space H, $A: H \to H$ is a completely continuous linear operator and λ is a real parameter.

The first chapter contains preliminaries.

In the second chapter, some elementary properties of the set of eigenvalues of variational inequalities are proved.

In the third chapter, the generalization of E. Miersemann's results on higher eigenvalues of variational inequalities in the potential case is given.

The fourth chapter brings a new method for obtaining the eigenvalues of variational inequalities. Moreover, this method gives some information on the solvability of the inequality (1).

In the last chapter, the existence of eigenvalues and bifurcation points of inequalities of reaction-diffusion type is proved.