ANALELE ŞTIINŢIFICE ALE UNIVERSITĂŢII "AL.I.CUZA" IAŞI
Tomul XLII, s.I.a, Matematică, 1996, f1.

CONSTANTIN I. BORŞ AND HIS CONTRIBUTION TO THE SCHOOL OF MECHANICS OF IAŞI

The mathematical school of Iaşi founded in 1910 within the framework of the Mathematics Seminar by Alexandru Myller, was developed and consolidated through the remarkable work of some great personalities, like Octav Mayer, brothers Mendel and Adolf Haimovici, Ion Creangă.

The departments of mechanics of this school was the creation of the scholar Mendel Haimovici, member of the Romanian Academy of Sciences. Continuing a long tradition in the teaching and research of mechanics, he succeded by an assiduous work to form a circle of researches whose results constitute the fondaments of the School of Mechanics of Iaşi.

A relevant contribution in developing of this School is due to Prof.dr. Constantin I. Borş who might have been 69 years in 1997 and four decades of his life in the scientific activity and higher education.

Prof.dr. Constantin I. Borş was born in the village Borşeni, commune Războieni, district of Neamţ, in 1928, August 24. After five years of elementary school he graduated *Liceul Petru Rareş* from the city Piatra Neamţ. His aptitude for mathematics had just developed during these school years. He continued the education at the Faculty of Sciences of Iaşi taking his degree in 1951. Simulataneously, he followed the courses in Civil Engineering.

After graduating from the University of Iaşi, he activated as researcher at the Mathematical Institute of Romanian Academy School of the University. During the period 1953–1957, he prepared his doctoral thesis under the guidance of Mendel Haimovici. In 1957, he took his Ph.D. with a valuable thesis entitlet *The extension, flexion and torsion of orthotropic bars.* Then he followed the Universitary carrear. In 1969 he was appointed to a professorhip to the Department of Mechanics of the Faculty of Mathematics and Mechanics. He also was the head of the chair of mechanics for a long time. As a professor, he taught courses of high scientific level, in Rational mechanics, Elasticity, Plasticity and Celestial mechanics.

Due to his scientific merits, Prof.dr. Constantin I. Borş has received the prize of the Ministry of Education (1959) and "Gh. Ţiţeica" prize of the Academy of Sciences in 1964. In 1975, he becomes *doctor docent* of the University of Iaşi. He specialized himself at some foreign universities from Poland, Czechoslovakia, USA, and Italy. He also participated in many international conferences where he presented some of his results in mechanics.

He died in April 27, 1996, leaving behind a lasting work and a bright figure of man and professor admired alike by his colleagues, collaborators and students.

In what follows we shall mention some scientific achievements of Constantin I. Borş.

His researches approaches three main domains of mechanics: the elasticity of deformable bodies, plasticity theory and celestial mechanics. In these domains he prepared over 70 papers which were published in Romanian Journals, as well as in a many foreign scientific reviews. He also wrote some books – *Lessons in Mechanics*, Tom I and II (1987) – for students use and a comprehensive monograph entitled *Theory of elasticity for anisotropic bodies* (1970).

In the Theory of Elasticity, he approached some basic problems regarding the deformation of homogeneous and nonhomogeneous (composed) anisotropic media, especially, that concerning the behaviour of bars with arbitrary transverse section and subjected to various kinds of loads. Two dimensional problems with rectilinear or cylindrical anisotropy including thermal effects have been also considered.

Let us review the main results from this domain.

At the beginning we must refer to the Ph.D. thesis which contains a detalied study regarding the deformation of cylindrical bars, composed from different orthotropic materials, which are subjected to axial traction, torsion or flexion by moments or transverse loads applied on ends. Later, these problems, placed in a more general framework, have been extended to bars made up from materials with a plane of elastic symmetry.

By using a semi-inverse method the original problem is reduced to some Dirichlet–Neumann boundary value problems for a plane multiple-connected domain defined by the transverse section of bar. Another result refers to a generalization of Bredt's theorem.

Some problems of two dimensional elasticity have also received a considerable attention. Among these we mention a series of papers in which are analysed the stress state in an anisotropic body with prescribed displacements or forces on its boundary. The method of thermoelastic potentials suggested by Goodier in the isotropic case was considerable extended by Professor Constantin I. Borş to the study of deformable materials with various kinds of anisotropy in the presence of a known stationary thermal field. Thus, he showed that a thermoelastic problem can be reduced to one elastic problem with certain body forces and some suppplementary superficial loads, which can be solved by usual methods of the elasticity theory.

Another results concern the equilibrium state of so called "non-cylindrical" bars. Here are comprised these bars whose lateral surface slightly differ from a cylindrical one as well as those having, in the reference configuration, a small bent of twisted longitudinal axis. Both these "imperfections" are mathematically described with the aid of a small parameter with the property that terms containing powers greater than two can be neglected. Then, an adequated geometric transformation of co-ordinates is performed so that, in the new variables, the lateral surface of the bar becomes a cylindrical one. This method is also applicable to almost cylindrical or slightly twisted bars subjected to end loads, cases which lead, at least, to some problems of Almansi type. The above method is also appropriate in the study of intially cylindrical bars which due to the action of some, later applied, loading forces, present residual stresses. It appears that such problems are both of theoretical and practical interest.

The relaxed Saint Venant's and Almansi–Michell's problems of a bar subjected to a given system of forces at its ends and, simultaneously, loaded over lateral surface has received a considerable attention by many researchers.

Professor Constantin I. Borş have also studied problems of this kind for anisotropic cylinders. By assuming the lateral loads be polynomial in the axial co-ordinate with variable coefficients defined on the transverse section of the bar, he succeeded to find the general solution of the problem by means of an algorithm every step of which implies the solution of a certain two dimensional problem. Thus, he obtained a unitary treatment of Saint Venant, Almansi and Almansi–Michell problems. The method was applied alike in the case of bars made from aorthotropic, anisotropic with a plane of symmetry as well as for bodies posessing a cylindrical or general rectilinear anisotropy.

All these problems involve new mathematical models the solution of which might have practical consequences.

Numerous results obtained by Professor Constantin I. Borş have been included in his rast monography *Theory of elasticity for anisotropic bodies* printed by the publishing house of Romanian Academy in 1970. This book, of 500 pages, constitutes the first work approaching the general theory of solid anisotropic media which has appeared in our country and which exceed, by context and problematic the monograph of S.G. Lechnitskii edited in 1950.

First of all in the book which we reffer the problems concerning the bars with various elastic symmetries, homogeneous or not, acted upon by combined loads has received an unitary treatment. Then, we must point out the use of the method of potentials (real or complex valued) in solving two dimensional problems of the elasticity and thermoelasticity theory for anisotropic media.

By this procedure the original boundary value problems are reduced to some systems of integral equations of Fredholm's type for which the solution exists.

Finally, taking into account the variety of problems, treated both from theoretical and practical point of view as well as the rich bibliography included, we conclude that this work becomes a reference book in the scientific

literature.

Another domain in which Prof.dr. Constantin I. Borş has important contributions is that of the Theory of Plasticity. Starting from the experimental results of the Japonese researchers K. Saiko, H. Jgaki and M. Unno, who shown that the plasticity condition proposed by Hill for orthotropic bodies is verified for copper and aluminium but not for zinc, he proposed, in 1966, a new plasticity condition, in which the role or hydrostatic pressure is played by certain stress applied on the faces of a cube which have the property of preserving the shape of cube after deformation.

The use of this condition of plasticity led to the obtaining of results pertaining to the problem of plane deformation.

His paper on variational principle regarding the plasticity of orthotropic bodies is also to be mentioned.

In the last decade of life, Professor Constantin I. Borş has been concerned with some difficult problems of which are intended to explain some discrepancies found between theoretical predicts and observational data. Essentially, these problems appear in the treating the two body problem in the framework of newtonian gravitation. They refer to the avance of planet perihelion and the deviation of the light ray in the presence of matter which cannot be explained in a satisfactory manner, unless if, one admits some modifications in the expressionof Newton gravitation force or one adopts some results of the Relativity Theory.

Studying the relative motion of a planet with respect to an appropriate non-inertial reference system having the origin in center of the Sun, Professor Constantin I. Borş succeeded in explaining, in several papers, the afore mentioned phenomena just in the framework of classical gravittional theory. Moreover, the results which are obtained following this statement of the problem are similar to that obtained by the Relativity Theory.

Unfortunately the death stoped his rich sceintific activity.

Before to finish this presentation, we4 wish to insist on the following two aspects concerning the activity of Professor Constantin I. Borş.

Firstly, a considerable number of his scientific results has been included into numerous other important monographs, his ideas constituting a veritable source of inspiration in developing of some new directions of research in mechanics.

Secondly, a great numbr of young mathematicins who were working for a doctoral degree under his guidance approached large themes of continuous media, isotropic and non isotropic elsasticity, plasticity, continuous media with microstructure and other. After the death of Mendel Haimovici some doctorate thesis was finished under the guidance of Professor Constantin I. Borş. After dissertations were in their final stage at the time of his death.

On the other hand, his devotion to science has substantially contributed to the consolidation of the School of Mechanics of Iaşi and, indubitable, his exemplary passion for didactic activity gave rise to an emulation spirit for its collaborators and young students.

All these make us add a sign of gratitude, a symbol of our deep appreciation to the memory of the Romanian mathematician Constantin I. Borş.

Aristotel Manolachi
Vasile Diaconiţa
Faculty of Mathematics
University of Iaşi
R-6600, Iaşi
ROMANIA

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ON MEROMORPHIC UNIVALENT FUNCTIONS WITH POSITIVE COEFFICIENTS AND WITH TWO FIXED POINTS

BY

M.K. AOUF and H.E. DARWISH

1. Introduction. Let Σ_p denote the class of functions of the form

$$f(z) = \frac{a_0}{z} + \sum_{n=1}^{\infty} a_n z^n \quad (a_0 > 0;\ a_n \geq 0) \tag{1.1}$$

which are analytic and univalent in $U^* = \{z : 0 < |z| < 1\}$ with a simple pole at the origin with residue 1 there.
A function $f(z) \in \Sigma_p$ is in the class $\Sigma_p^*(\alpha,\beta,\gamma)$ if it satisfies the condition

$$\left| \frac{z^2 f'(z) + a_0}{(2\gamma - 1)z^2 f'(x) + (2\alpha\gamma - 1)a_0} \right| < \beta \quad (z \in U^*) \tag{1.2}$$

for some α $(0 \leq \alpha < 1)$, β $(0 < \beta \leq 1)$ and γ $(\frac{1}{2} \leq \gamma \leq 1)$.

We note that for $a_0 = 1$, the class $\Sigma_p^*(\alpha,\beta,\gamma) = \Sigma_p(\alpha,\beta,\gamma)$ was studied by Cho, Lee and Owa [1].

For a given real number z_0 $(0 < z_0 < 1)$ let Σ_{p_i} $(i = 0, 1)$ be the subclasses of Σ_p satisfying $z_0 f(z_0) = 1$ and $-z_0^2 f'(z_0) = 1$, respectively. Let

$$\Sigma_{p_i}^*(\alpha,\beta,\gamma,z_0) = \Sigma_p^*(\alpha,\beta,\gamma) \cap \Sigma_{p_i} \quad (i = 0, 1). \tag{1.3}$$

In this paper we obtain coefficient estimates, distortion theorems, closure theorems and radius of convexity of order δ $(0 \leq \delta < 1)$ for the classes $\Sigma_{p_i}^*(\alpha,\beta,\gamma,z_0)$ $(i = 0, 1)$. Further we determine a necessary and sufficient condition that a subset B of the real interval $]0, 1[$ should satisfy the property that $\bigcup_{z_r \in B} \Sigma_{p_0}^*(\alpha,\beta,\gamma,z_r)$ and $\bigcup_{z_r \in B} \Sigma_{p_1}^*(\alpha,\beta,\gamma,z_r)$ each forms a convex