

## DEVELOPMENT OF THE THEORY OF MAGNETOELASTICITY IN ARMENIA

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One of the essential directions in Armenology is the study of the impact of the Armenians in the development of world science. Already during the Golden Age of medieval Armenian literature were laid rudimentary concepts of natural sciences.

Studies of mathematical materials and archaic mathematical surveys which are kept among the manuscripts of Matenadaran, Institute of Manuscripts (Yerevan) showed that mathematics and other natural sciences (astrology, medicine, etc.) had an essential place in the intellectual development of ancient and medieval Armenia.

The study of numerals which are referred to in the cuneiform inscriptions of the kingdom of Van (Urartu) clearly shows that still in this early period was used the decimal system of calculation which was basically different from that in Egypt, as well as parallel arithmetical systems known from other countries.<sup>1</sup>

The medieval Armenian sources dealing with mathematical sciences show that the Armenians already in the fifth century had mastered the Greek art of calculation.<sup>2</sup> From the information concerning David Anhaght, the prominent Armenian philosopher (V century AD), one can conclude that his works contain interesting ideas about astronomy, mathematics, biology, medicine and other scientific fields.

David Anhaght finds that mathematics rests on physical objects, but mathematics abstracts their materialism and makes the mental developments as object of the study. This conclusion could be supported through his idea that mathematics deals with material entity, but as an idea - with immaterial one.<sup>3</sup>

David Anhaght considers also the methods of scientific investigations regarding the necessity of the classification of ideas. He found that not all phenomena could be directly and simply understood. The recognition of different phenomena is not carried out on the same level: "Because the nature did not conceal all objects from us, – says David Anhaght, - otherwise nobody can discover anything, and not anything became evident and nobody could study something, even to fire a single candle".

Rightly considered as Armenian Aristotle, David Anhaght built a platform on which the genius ideas of Armenian authors rested henceforth, developing different directions of science, through which Armenian people was renowned worldwide.

The next prominent figure of Armenian genius was Anania Shirakatsi. Indeed, the humanity could not jump and bypass three centuries through emptiness of ideas. Certainly, some genius people used to exist, because the difference between the scientific levels of Anania Shirakatsi and David Anhaght is very large. Here one must

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<sup>1</sup> Abrahamyan et al. 1979.

<sup>2</sup> Petrosyan 1959.

<sup>3</sup> Brutyan 2004.

quote the well-known phrase ascribed to Isaac Newton. "I managed to see further than others since I stood on the shoulders of the giants". But because we do know nothing about such giants in Armenia, we are forced to take Shirakatsi as a starting point in evaluating the mathematical thought in Armenia, since this field yet lacks summarizing studies. From the V century AD when Armenia had lost its independence until the times of Shirakatsi hardly one could not expect the existence of solid attitude towards mathematics.

Despite this, regardless the statehood and nationality, scientific thought always has a possibility to break through different obstacles, thus developing scientific ideas worldwide. The brilliant evidence of the aforementioned is the book of arithmetics written by A. Shirakatsi (VII century AD), which is the oldest book reached to us. It contains the tables of four arithmetical functions, which fundamentally is different from Greek mathematical works.

In Armenia the mathematical science reached its height during the Bagratid Kingdom. The study of the mathematical works of Nikoghayos Artavazd, a XIV century author, shows that the works of Anania Shirakatsi and his followers later were spread into the Byzantine Empire, hence promoting the development of mathematical sciences there.<sup>4</sup>

In favor of the highly developed mathematical ideas during the Middle Ages speak the fact that the Armenians had passed to the decimal system of calculation still in the second half of the XV century, parallel with the countries of Western Europe.<sup>5</sup>

The printed Armenian mathematical literature of the XVII–XVIII centuries include textbooks written in Grabar (Classical Armenian) and spoken Armenian languages, some of which, due to their simple style and accessibility, could be ranked as one of the best among the educational literature of the time being.

Mathematics as a queen of the sciences paved the way for the promotion of natural sciences. It gave a possibility for the development of numerous adjacent sciences. In Armenia the hard sciences began to develop faster later when the Armenians established contacts with scientific and cultural centers of the time.

The complete history of the development of hard sciences in Armenia could be written only after the evaluation of the impact of Armenian scholars.

In this article is made an attempt to present one of the fields of hard sciences which has reached a fairly high level in Armenia, particularly the influence of the electromagnetic fields on the dynamic phenomena carried out in the deformable media. The interaction of the electromagnetic fields with the electroconductive thin bodies first was investigated in 1960s by the Polish scholar S. Kaliski.

In Armenia the founders of the magnetoelasticity were S.A. Ambartsumyan, G.E. Baghdasaryan, and M.V. Belubekyan. They had formulated the theory of the electromagnetism for thin bodies. They had suggested effective methods for the applied

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<sup>4</sup> Vantsyan 2013: 218.

<sup>5</sup> Vantsyan 2012: 287.

problems regarding electroactive shells and plates. Using the theory of S.A. Ambartsumyan, were revealed new phenomena regarding the interaction of thin bodies and strong electromagnetic fields.<sup>6</sup> Numerous results of studies authored by scholars mentioned above have been published in several monographs.<sup>7</sup> The exact solutions of the problems of magnetoelasticity for the bodies by finite measurements and electroconductivity are connected with serious difficulties.<sup>8</sup> Therefore, the approximate methods, particularly the hypotheses of non-deformable normals receives special importance.

The hypotheses suggested by the abovementioned authors gave a possibility for the solution of essentially difficult problems, and “to fire a candle instead of cursing the darkness”, thus turning Armenia into one of the renowned scientific centers of the world in this field.

The studies of G.E. Baghdasaryan, Z.N. Danoyan and their students are devoted to the propagation of electroelastic waves through bodies having different physical properties.<sup>9</sup> The problems of the vibration of current-carrying plates and shells in the magnetic field were studied by K.B. Ghazaryan, and that of A.A. Avetisyan - to the propagation of waves in piezoelectric media.

The problems of the another class of the interaction of electromagnetic fields and deformable media in Armenia, particularly the penetration phenomena of the rigid bodies into other media were initiated by A.G. Bagdoyev and the current author, beginning from 1978-1979, on the basis of plate section hypotheses. Despite some shortcomings, this hypotheses laid a background for revealing some peculiarities of the problem. Particularly, theoretical formulas for calculation of the depth of penetration and crater dimensions in the problem of penetration of the projectiles and bullets into targets were obtained, which secure required exactness for the practical problems.<sup>10</sup> Here arises a question of defending the properties of the armor.

In 1978–1979 we had suggested the usage of electrodynamic method for defending of the armor (later named after the author). In 1988–1990 we directed the joint program between the Institute of Steel and Alloys, Russian Federation, and the Institute of Mechanics, Armenian National Academy of Sciences. The results were more than satisfactory; the armor became invulnerable.<sup>11</sup>

In 1990 A.A. Vantsyan and his co-author A.G. Bagdoyev were awarded with the second prize of the National Academy of Sciences of Armenia. Later, in 1990s we, trying to explain the obtained phenomenon, on experimental basis had discovered a new law dealing with the discharge currents in metallic media. According to this law, in metallic media the densities of discharge currents are transformed into the Furye series.

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<sup>6</sup> Ambartsumyan, Baghdasaryan, Belubekyan 2012.

<sup>7</sup> Ambartsumyan, Baghdasaryan 1996.

<sup>8</sup> Baghdasaryan 1999.

<sup>9</sup> Baghdasaryan, Danoyan 2006.

<sup>10</sup> Vantsyan 2004.

<sup>11</sup> Vantsyan, Moravej 2011.

In agreement with the obtained results the harmonics of low frequency proceeds receiving minimal resistance, and the high frequency harmonics are forced towards the surface of the media (the famous spin effect).

On the basis of theoretical and experimental investigations one can conclude that the influence of the electromagnetic fields on numerous phenomena carried out in the nature and human organism is very essential, a problem which should be studied in future.

One must mention also that in 1998 we found a new method regarding the solution of algebraic and transcendental equations. From the point of convergence of the iteration processes the new method surpasses all existing methods.

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