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Some Problems of Georgian Mathematical Terminology

The term, as is well known, is a word, expressing certain notions in different branches of art, literature or science. As the new social-political or technological concepts spread all over the world, more and more foreign words enter the language. Georgian scholars (linguists as well as scientists in different branches) always tried to create authentic Georgian terms, e.g. for sports terms, such as football, volleyball, tennis, basketball, etc., unlike Russian, authentic Georgian terms – *ფეხბურთი, ფრენბურთი, ჩოგბურთი, კალათბურთი* – were created. There are special terms in mathematics as well.

In modern times when all the fields of science are being developed, new terms have been created, especially in such fields as applied mathematics and computer science which naturally requires elaboration of terminology and equalizing it with international standards. And this process should be based on the foundations of the foreign as well as the Georgian languages.

Georgian mathematical terminology has almost century old traditions. As early as in the twenties of the last century, great Georgian mathematicians N.Muskhelishvili, G.Nikoladze, A.Razmadze, A.Kharadze created Georgian equivalents for such terms, as *equation, equality, inequality, power, division, unit(y), multiplicand, factor, remainder, prime number, degree, subtraction, multiplication, division, addition, probability, line, isosceles, curve,* etc.

In most cases terms are translated into Georgian from other

languages. The system of translation with respect to word combinations(syntagma) must be founded on the basis of the Georgian as well as the foreign language it has been translated from. It should be taken into account that the Georgian and Latin, Greek or Western European languages have entirely different structures and before reaching Georgian the terms have passed through other "medium" languages and the lexicographer must try to choose the term which he thinks most relevant.

In formation of Georgian mathematical terms there are several aspects which are worth mentioning, the following most important among them:

for instance, in the case of adjectives there has been some "order" reached – when adjectives of foreign origin take the Georgian suffix -*ურ(-ული)* and in other cases – the suffix -*ალ(-ური)* which is the combination of two similar suffixes: one of the non-Georgian -*al,* the other of the Georgian -*ურ(-ული).* In Georgian the unnecessary -*al* has been dropped. For instance, in the case of adjectives there has been some "order" reached – when adjectives of foreign origin take the Georgian suffix -*ურ(-ული)* and in other cases – the suffix -*ალ(-ური)* which is the combination of two similar suffixes: one of the non-Georgian -ალ, the other of the Georgian -*ურ(-ული).* In Georgian the unnecessary -*ალ* has been dropped and now we have *დოკუმენტური* and not *დოკუმენტალური*, *ფუნდამენტური* and not *ფუნდამენტალური*, *ექსპერიმენტული* and not *ექსპერიმენტალური*, *პენინტენციური* and not *პენინტენციალური*, *დიამეტრული* and not *დიამეტრალური*, *ტერიტორიული* and not *ტერიტორიალური* etc. It should be noted however that in mathematical terms the suffix -ალ can sometimes be kept, since it is in the stem of the word and thus we have *დიაგონალური*(*დიაგონალი*), *დიფერენციალური* (*დიფერენციალი*), *ვერტიკალური* (*ვერტიკალი*), *ჰორიზონტალური* (*ჰორიზონტალი*) and so on.

In a number of cases the incorrect forms have been replaced by correct ones and here again the stem of the word is taken into account,

e.g. we have *ტანგენსური* and not *ტანგენციალური*, *ელიფსური* and not *ელიპტიკური*, *ანალიზური* (*ანალიზი*) *ანალიტიკური* (*ანალიტიკა*), *ეკონომიური* (*ეკონომია*), *ეკონომიკური* (*ეკონომიკა*)

Of importance is also the consideration of foreign scientists' names and the transformation they have undergone before being conveyed into Georgian. They should be transferred in a proper way since a theory created, a problem solved or a question set forth by a certain scientist, be it a Newton's binomial, Abel means or Pascal's limaçon gives us a mathematical term with scientists' names forming part of it. We think that the transfer and unification of foreign names as terms is a long and complicated process. It is very important to apply correct rules of transliteration in conveying them into Georgian in a suitable form.

With the examples, given in the new Georgian-English mathematical dictionary, compiled by me, it is clearly seen how proper names, used in eponyms, are turned into mathematical terms. For the regulation of mathematical terms in general we should try: 1. To write and pronounce foreign names in a proper way, 2. To find exact Georgian equivalent transliteration for them, e.g. such French names as *Hénon* – *ენო*, *Deaulbault* – დოლბო, *Foucault* – *ფუკო*, *Bruhat* – *ბრიუა*, *Duhamel* – *დიუამელი*, *Darbout* – *დარბუ*, *Cosserat* – *კოსერა* are often spelt incorrectly. The rules of French orthography are violated in conveying French names, for instance, in the case of the names Fresnel and Oresme, the consonant s is often included in the Georgian version which is incorrect. So we should have *ფრენელი* and *ორემი* and not *ფრესნელი* and *ორესმი*. The same can be said about the sound combination gn in French and Italian which should be read as *ნ* and not *გნ* which is sometimes the case in Georgian. So we must read *Signiorini* – *სინიორინი* and *Agnesi* – *ანიეზი*.

The right regulations have been made with respect to German diphthongs *ei* and *eu.* So Weierstrass in Georgian must be read as *ვაიერშტრასი* instead of *ვეიერშტრასი*, Seifert must be read as *ზაიფერტი* and not *ზეიფერტი*; Schneider must be read as *შნაიდერი* and not *შნეიდერი*; Steinhaus must be read as *შტაინჰაუსი* and not

შტეინჰაუსი; *Freudental* must be read as *ფროიდენტალი* and not *ფრეიდენტალი*, *Euler* must be read as *ოილერი* and not *ეილერი*.The same can be said about the incorrect transfer of the German vowel ü. We should pronounce Gödel – გიოდელი and not *გედელი*, *Grötzsch* – *გრიოტში* and not *გრეჩი*, *Hörmander* – *ჰიორმანდერი* and not *ჰერმანდერი*, *Hölder* – *ჰიოლდერი* and not *ჰელდერი*, *Schrödinger* – *შრიოდინგერი* and not *შრედინგერი* and so on.

In transferring the scientist's name properly, we should take into account the origin of the surname. For example, the name of the German mathematician *Dirichlet* is pronounced as *დირიხლე*, but earlier this name because of its French origin was read as *დირიშლე*. His ancestors went to Germany from the Belgian town Richlet and his grandfather was called le jeune de *Richlet* (a young man from Richlet). Later since he was considered to be a German mathematician and in German the sound combination ch is read as ხ there remained two parallel forms: *დირიხლე* and *დირიშლე.* There is also an interesting story with another mathematician Kladni. His ancestors who were from Krenik (Hungary) went to live in Germany. Krenik now belongs to Slovakia, so he is sometimes mentioned as German, sometimes Slovak and sometimes as a Hungarian mathematician. Consequently, his name is pronounced either as *კლადნი* or *ხლადნი.*

A person who is compiling a dictionary or just has to do with terms, should be very accurate with terms, especially when a scientist's name is considered. For, instance, when I first came across the expression SHY SET from the set theory, was very surprised – how can a set be shy? And the other mathematicians, not working in the same field in the field of set theory couldn't give me an answer. Then I found out that it was the abbreviation of three mathematicians' names - Sauer, Hunt and Yorke. Thus I avoided a rough mistake!

We have already mentioned that there are special terms in mathematics as well, where one can often meet terms, composed of mathematicians' names. These terms are, as a rule, two-component and consist of the defining and defined words. These words are often

connected by means of the English suffixes - *ean*, -*ian*, -*ine*. These so called suffixes of possession are added to the proper names and thus the eponymous adjectives are formed.

But it should be noted that this process of transformation or "term-creating" is not final. It involves double transformation, i.e. the first step is when the above suffixes are added to proper names and we get adjectivization, e.g. Archimedes-Archimed-ean, Lagrange – Lagrang-ian, Laplace-Laplacian, etc. Then in a variety of cases we have again substantivization of these adjectives and we get the term. In such a case the term is obtained from the proper name,e.g. *Gauss – Gaussian*, *Berezin – Berezinian*, *Jacob – Jacobian*, *Lipschitz – Lipschitzian , Naper – Naperian*, etc. Substantivization by means of –ian, -ean, -ine suffixes does not always take place. But in a number of cases this substantivized one-compomemt noun, obtained from the proper name (eponym) is a full substitute for a two-component term, for example, *Gaussiani* is a *Gaussian* distribution, but the word distribution is not used any more and we have only Gaussian გაუსიანი. The same is with Grassmanian – Grassmanian space – space has been dropped and we have just *Grassmania – გრასმანიანი.* So the other similar terms are Wronskian for the Wronskian determinant, Hamiltonian for the Hamiltonian operator, etc.

Even more interesting and paradoxical is the fact that in Georgian the transfer of this substantivized term was very natural for Georgian by means of the suffix -ian. As is known, the lexical system of every language has its specifics and as we have already mentioned, Georgian and English have absolutely different structures but in this particular case there was a strange coincidence, since the possessive suffix *ian* is just the same in both languages. For instance, in Georgian possession is expressed with the help of this suffix – *იანი*: *ცოლი – ცოლიანი*, *ღრუბელი – ღრუბლიანი*, *ცრემლი – ცრემლიანი, ფასი – ფასიანი.* This ending is characteristic of Svan surnames in Georgian. So such terms as *გაუსიანი* (*Gaussian*), *გრასმანიანი* (*Grassmanian*) and *რიმანიანი* (*Riemannian*) sound very natural in Georgian.

In transferring foreign terms into Georgian great attention should also be paid to foreign prefixes (prefixation). Prefixes in foreign languages (say, in English) have in their turn been translated from Latin and Greek. In mathematical terms we have the Georgian words with foreign prefixes and vice versa.

On the whole, it can be said that full *standartization* of terms is impossible. There always remains some distinctiveness in the languages. So we must always try to detect the rules which determine the diversity of Georgian mathematical terms. And this can be reached only by joint efforts of linguists and mathematicians.

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საკვანძო სიტყვები: მათემატიკური ტერმინოლოგია, სინტაგმა, ეპონიმები, ორთოგრაფია, ტერმინთშემოქმედება

ქართული მათემატიკური ტერმინოლოგიის ზოგი საკითხისათვის

როგორც ცნობილია, ქართულ მათემატიკურ ტერმინოლოგიას მდიდარი ტრადიცია აქვს. ჯერ კიდევ გასული საუკუნის 20-იან წლებში ისეთმა დიდმა მეცნიერებმა, როგორებიც იყვნენ: ნ. მუსხე-

ლიშვილი, გ. ნიკოლაძე, ა. რაზმაძე, ა. ხარაძე, დიდი წვლილი შეიტანეს მათემატიკური ტერმინოლოგიის განვითარებაში. მათ მიერ არის შექმნილი ისეთი მათემატიკური ტერმინები, როგორებიცაა, მაგალითად: *განტოლება, ტოლობა, უტოლობა, ალბათობა, ტოლფერდა, მრუდი* და სხვ.

თანამედროვე ეპოქაში, როცა მეცნიერების ყველა დარგი ვითარდება, იქმნება ახალი ტერმინები, განსაკუთრებით გამოყენებითი მათემატიკისა და კომპიუტერული მეცნიერებების დარგში, რაც თავისთავად მოითხოვს ტერმინოლოგიის დახვეწასა და საერთაშორისო სტანდარტებთან გათანაბრებას. ეს პროცესი უნდა ემყარებოდეს როგორც უცხო, ისე ქართული ენის საფუძვლებს.

ტერმინოლოგიის სრული უნიფიცირება შეუძლებელია. ენაში ყოველთვის რჩება გარკვეული სიჭრელე. ამიტომ სასურველია დადგინდეს ის კანონზომიერება, რაც განაპირობებს ქართულ ტერმინთა ნაირგვარობას და ეს შეიძლება მიღწეული იქნეს მხოლოდ ენათმეცნიერთა და მათემატიკოსთა ერთიანი ძალისხმევით.