LUYANJA: A SAMPLE TEXT

By

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It will be recalled that in the last two months I have posted two papers on Luyanja on this site. First, I heralded Luyanja under "Announcing the Emergence of Luyanja". As a sequel to that I presented a list of circa 200 affixes of Luyanja under "A Reference List of Luyanja Affixes". The purpose of the present paper is to afford the critically circumspect reader, especially the well scientifically tutored reader, a glimpse at Luyanja in actual use. The sample text is extracted from what normally counts as a basic university textbook on physics or applied mathematics. A clarification is in order from the very outset: the rendition into Luyanja is intentionally left unannotated. Finally, if you are a scientist without a reading knowledge of Luganda, it will be virtually an uphill task to appreciate the import of the paper.

Extract

VECTORS, VELOCITY and ACCELERATION

MECHANICS, KINEMATICS, DYNAMICS AND STATICS

Mechanics is a branch of physics concerned with motion or change in position of physical objects. It is sometimes further subdivided into:

(1) *Kinematics*, which is concerned with the geometry of the motion,
(2) *Dynamics*, which is concerned with the physical causes of the motion,
(3) *Statics*, which is concerned with conditions under which no motion is apparent.

AXIOMATIC FOUNDATIONS OF MECHANICS

An axiomatic development of mechanics, as for any science, should contain the following basic ingredients:

(1) *Undefined terms or concepts*. This is clearly necessary since ultimately any definition must be based on something which remains undefined.
(2) *Unproved assertions.* These are fundamental statements, usually in mathematical form, which it is hoped will lead to valid descriptions of phenomena under study. In general these statements, called *axioms* or *postulates*, are based on experimental observations or abstracted from them. In such case they are often called *laws*.
(3) *Defined terms or concepts*. These *definitions* are given by using the undefined terms or concepts.
(4) *Proved assertions*. These are often called *theorems* and are proved from the definitions and axioms.

An example of the"axiomatic way of thinking" is provided by *Euclidean geometry* in which *point* and *line* are undefined concepts.

MATHEMATICAL MODELS

A mathematical description of physical phenomena is often simplified by replacing actual physical objects by suitable *mathematical models*. For example in describing the rotation of the earth about the sun we can for many practical purposes treat the earth and sun as points.

SPACE, TIME AND MATTER

From everyday experience, we all have some idea as to the meaning of each of the following terms or concepts. However, we would certainly find it difficult to formulate completely satisfactory definitions. We take them as undefined concepts.

(1) *Space*. This is closely related to the concepts of *point*, *position*, *direction* and *displacement*. Measurement in space involves the concepts of *length* or *distance*, with which we assume familiarity. Units of length are feet, meters, miles, etc. In this book we assume that space is *Euclidean*, i.e. the space of *Euclid's geometry*.

(2) *Time*. This concept is derived from our experience of having one *event* taking place after, before or simultaneous with another *event*. Measurement of time is achieved, for example, by use of *clocks*. Units of time are seconds, hours, years, etc.

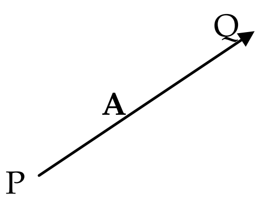
(3) *Matter*. Physical objects are composed of "small bits of matter" such as atoms and molecules. From this we arrive at the concept of a material object called a *particle* which can be considered as occupying a point in space and perhaps moving as time goes by. A measure of "quantity of matter" associated with a particle is called *mass*. Units of mass are grams, kilograms etc. Unless otherwise stated we shall assume that the mass of a particle does not change with time.

Length, mass and time are often called *dimensions* from which other physical quantities are constructed. For discussion of units and dimensions see Appendix A, Page 339.

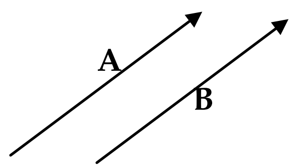
SCALARS AND VECTORS

Various quantities of physics, such as length, mass and time, require for their specification a single real number (apart from units of measurement which are decided upon in advance). Such quantities are called *scalars* and the real number is called the *magnitude* of the quantity. A scalar is represented analytically by a letter such as *t*, *m*, etc.

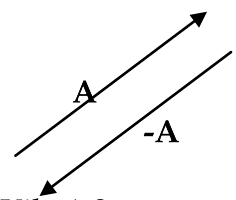
Other quantities of physics, such displacement require for their specification a *direction* as well as magnitude. Such quantities are called *vectors***.** A vector is represented analytically by a bold faced letter such as **A** in Fig. 1-1. Geometrically it is represented by an arrow PQ where P is called the *initial point* and Q is called the *terminal point*. The magnitude or length of the vector is then denoted by |**A**| or *A*.



Kib. 1-1



Kib 1-2



Kib. 1-3

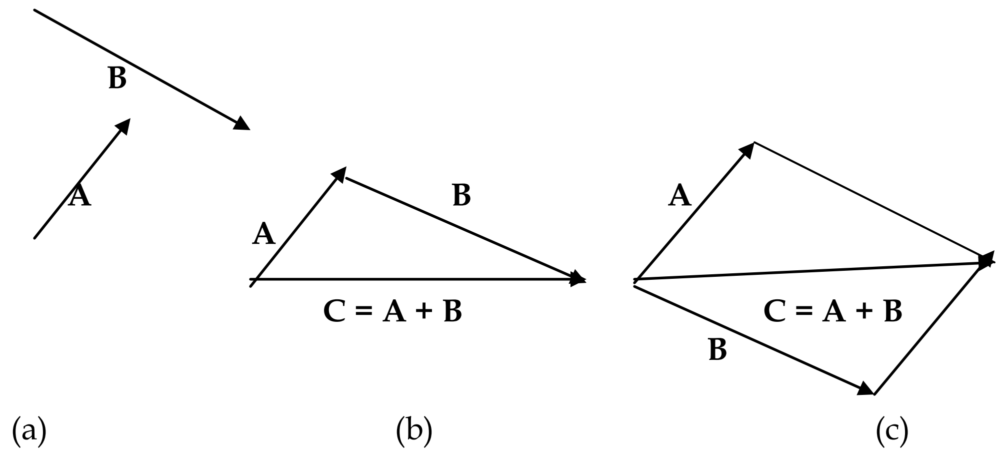
VECTOR ALGEBRA

The operations of addition, subtraction and multiplication familiar in the algebra of real numbers are with suitable definition capable of extension to an algebra of vectors. The following definitions are fundamental.

(1) Two vectors **A** and **B** are *equal* if they have the same magnitude and direction regardless of their initial points. Thus **A** = **B** in Fig. 1-2 above.

(2) A vector having direction opposite to that of vector **A** but with the same length is denoted by **–A** as in Fig. 1-3 above.

(3) The *sum* or *resultant* of vectors **A** and **B** of Fig. 1-4(a) below is a vector **C** formed by placing the initial point of **B** on the terminal point of **A** and joining the initial point of **A** to the terminal point of **B** [see Fig. 1-4(b) below]. We write **C** = **A** + **B**. This definition is equivalent to the *parallelogram law* for vector addition as indicated in Fig. 1-4(c) below.



Kib 1 -4

Extensions to sums of more than two vectors are immediate. For example, Fig. 1-5 below shows how to obtain the sum or resultant **E** of the vectors **A, B, C** and **D.**

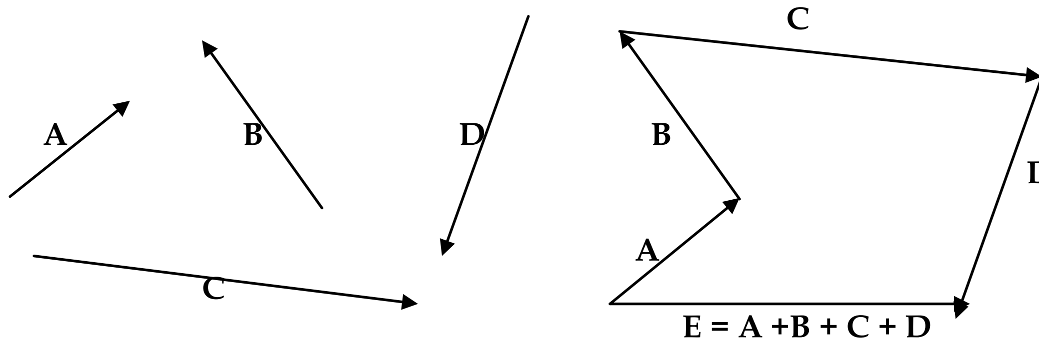


Fig. 1-5

(4) The *difference* of vectors **A** and **B**, represented by **A** - **B**, is that vector **C** which when added to **B** gives **A.** Equivalently, **A** - **B** may be defined as A + (-**B).** If **A** = **B**, then **A** - **B** is defined as the *null or zero vector* represented by **0**. This has a magnitude of zero but its direction is not defined.

(5) The *product* of a vector **A** by a scalar *p* is vector *p***A** or **A***p* with magnitude |p| times the magnitude of **A** and direction the same as or opposite to that of **A** according as *p* is positive or negative. If *p*= 0, *p***A**= **0**, the null vector.

Murray R, Spiegel (1967) *Theoretical Mechanics, Chapter 1 pp 1-3:* Shaum's Outline Series, Mc-Grain Book Company

Translation into Luyanja

ZIVEKTA, OMUSONGAWILO, NE OMWANGUWILO

MEKANIKA, KINEMATIKA, DYUNAMIKA NE STATIKA

Mekanika ttabi lya fyusika elyekuusa ku kusonga oba okukyuka ekyeteeko/ekyesangilo kya emibili emifyusikafa. Mekanika oluusi agabawansibwamu:

(1) *Kinematika*, eyekuusa ku wapimansi wa okusonga,
(2) *Dyunamika*, eyekuusa ku ebileetela ebufyusikafa bya okusonga,
(3) *Statika*, eyekuusa ku mbeela omutayolekelwa kusonga.

EMISINGI EMIAXIOMAFA GYA MEKANIKA

Okwanjuluza mekanika ekiaxioma, nga ela bwe kiba kulwa wakumanya omulala yenna, kwandisaanidde kubeleemu ebigendamilasinga bino:

(1) *Ebimiimo oba ebikwatawamo ebitasonjole*. Kino awatali kuwannaanya kikaka kubanga mu buli ngeli buli kisonjolo kyonna kiteekwa okwesigamizibwa ku kintu ekisigala nga si kisonjole.
(2) *Ebikazo ebitakakase*. Bino bitegeezasingo, nga bitela kuba mu kikula kimathematikafa, nga kisuubilwa nti binatuusa ku nzitottolo za ebyeyolesa ebiyitibwa *axioma* oba *ebisabo*, byesigamizibwa ku bikengo ebigezesafa oba binogolwako. Bwe kiba bwe kityo bitela okuyitibwa *amateeka***.**
(3) *Ebimiimo oba ebikwatawamo ebisonjole*. Ebisonjolo bino biweelebwa mu kukozesa ebimiimo oba ebikwatawamo ebitasonjole.
(4) *Ebikazo ebikakase*. Bino bitela kuyitibwa *biwandabo* ela bikakasibwa kuva mu bisonjolo ne axioma.

Ekyokulabisisa "endowooza ya ekiaxioma" kiweebwa wapimansi owa ekiEuclid omuli *akafunitilo* ne *oluteleevu* nga ebikwatawamo ebitasonjole.

EBIGEEGEENYO EBIMATHEMATIKAFA

Ekittottolo ekimathematikafa ekya ebyeyoleso ebibilifa kitela okuwewulwa nga ebikuuli byennyini ebifyusikafa biwaanyisibwa na *ebyigeegeenyo ebimathematikafa.*

Okugeza, mu kuttottola okwekulungulila kwa nnattaka ku njuba tuyinza okutwala nnattaka ne enjuba nga otufumitilo mu nkola eya bulijjo.

EBBANGA, EKISEELA NE MATERIA

Okuva mu bumanyilivu obwa bulijjo ffenna tulina ekitegeelo kya makulu ga buli ku bimiimo oba ebikwatawano ebiddilila. Kyokka, ddala twandilemelelwa okwasanguzaddala ebisonjolo ebimatiza. Tubitwala nga ebikwatawamo ebitasonjole.

(1) *Ebbanga.* Lino ligandanila ddala ne ebikwatawamo bya *akafumitilo , akateekelo, oluyolekelo* ne *oluseetuko.* Okupimila mu bbanga kuzingilamu ebikwatawamo bya *obuwanvu* oba *olwesuulo*, bye tutwala nga bimanyiddwa. Eminwe gya obuwanvu ze ffuuti, metra, mailo, nll. Mu kitabo kino ebbanga tulitwala okuba elya ekiEuclid, k.k. ebbanga lya wapimansi wa Euclid.

(2) *Ekiseela*. Ekikwatawamo kino kiviisibwa mu bumanyilivu bwaffe mu kuba ne *ekituuko* okubeelawo oluvannyuma, mu maaso oba mu kiseela kye kimu ne *ekituuko* ekilala. Okupima ekiseela tukozesa ssaawa, nga ekyokulabilako. Eminwe gya ekiseela ze sikonda, ssaawa, myaka, nll.

(3) *Materia*. Ebikuuli ebifyusikafa bibaamu “otukunkumuka twa materia“ nga atoma ne otumola. Okuva wano tutuuka ku kikwatawamo kya ekikuuli ekimateriafa ekiyitibwa *akasilikitu* aksaobola okulowoozebwako nga katwala kafumitilo mu bbanga ela nga kaseguka nga ne ekiseela bwe kigenda.

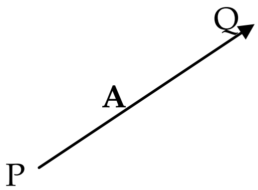
Ekipimo kya “obungi bwa materia“ ekinywanyibwa ne akasilikitu kiyitibwa *omutole* gwako. Eminwe gya omutole ze grama, kilograma, nll. Okuggyako nga kitegeezebbwa tujja kukitwala nti omutole gwa akasilikitu tegukyuka na kiseela.

Obuwanvu , omutole ne ekiseela bitela okuyitibwa *empimo* ebingi ebifyusikafu ebilala mwe biviisibwa. Olwa ekinyeenyawuno ku minwe ne empimo laba Enkookelo A, Oluuyi 339.

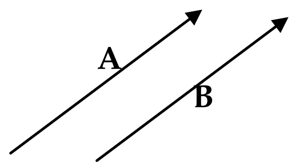
EBIDAALAFA NE VEKTA

Ebingi ebyawufu bya fyusika, okugeza obuwanvu, omutole ne ekiseela byetaagisa ennamba wawu emu okubyatuukiliza (okuggyako eminwe gya okupima egikkaanyizibwako ku ntandikwa). Ebingi bwe bityo biyitibwa *bidaalafa* ela ennamba wawu eyitibwa *obwaguuga* bwa ekingi. Kiyunguluzi, ekidaalafa kibakilwa na nnukuta nga , *t*, *m* , nll.

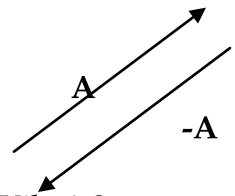
Ebingi bya fyusika ebilala, okugeza oluseetuko, byetaagisa *luyolekelo* ne obwaguuga okwatuukilizibwa. Ebingi bwe bityo biyitibwa *vekta***.** Kiyunguluzi , vekta ebakilwa na nnukuta entwakaavu nga **A** mu Kib[*] 1.1. Kipimansi ebikilwa na kasaale PQ nga P eyitibwa *akafumitilo akasooka* ate nga Q eyitibwa *akafumitilo kakoobela*. Obwaguuga oba obuwanvu bwa vekta bulambibwa na |**A**| oba *A*.



Kib. 1-1



Kib 1-2



Kib. 1-3

ALGEBRAAVEKTA

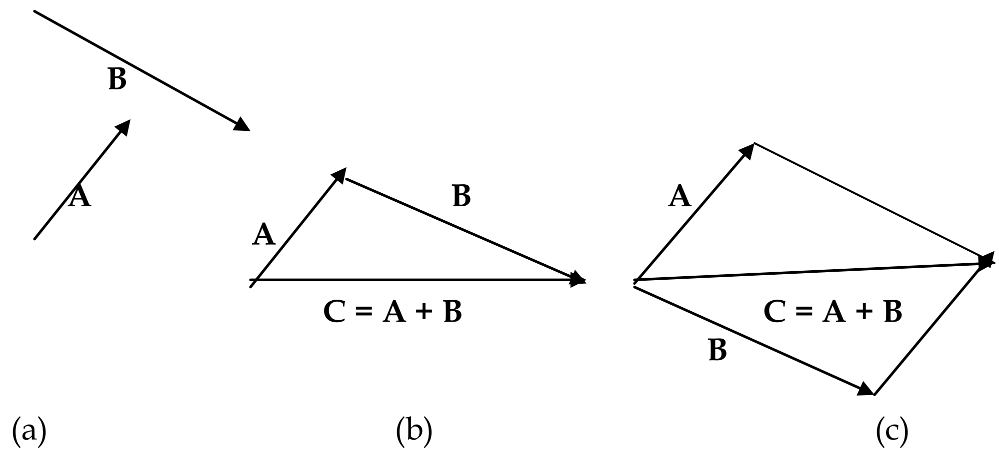
Ebikolebwa bya okugatta, okutoola ne okubaza ebimanyiddwa ennyo mu algebra wa ennamba wawu bisobola okugaziyizibwa okutuuka ku algebra wa vekta nga ensojola esaanidde ekozesebbwa. Ebisonjolo wammanga bya ku musingi.

(1) Vekta bbili **A** ne **B** *zenkana* singa ziba ne obwaguuga ne oluyolekelo bye bimu awatali kufa ku tufumitilo twazo otusooka. Noolwekyo **A = B** mu Kib. 1-2 waggulu

(2) Vekta elina oluyolekelo olukontana ne olwo olwa vekta **A** naye nga elina obuwanvu bwe bumu elambibwa na **–A** nga mu Kib. 1-3 waggulu.

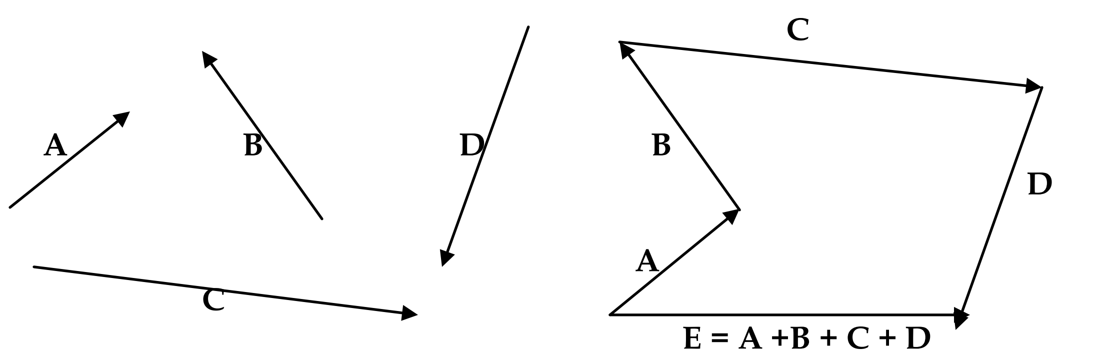
(3) *Omugatto oba omuviiso* gwa vekta **A** ne **B** eza Kib.1-4(a) wammanga ye vekta **C** ezimbibbwa nga akafumitilo akasooka aka **B** kateekebwa ku kafumitilo akakoobela ka **A** ela nga akafumitilo akasooka ka **A** kayungibwa ku kafumitilo akakoobela ka **B** (laba Kib. 1-4(b) wammanga) Tuwandiika **C= A + B**. Ekisonjolo kino kiwendonkana *etteeka lya ollundiikasegalala* olwa okugatta vekta nga bwe kilagiddwa mu Kib. 1-4(c) wammanga.

[*] Kib. = Kibaka



Kib 1 -4

Engaziyo ezituuka ku migatto gya vekta ezisukka mu bbili ntakatika. Okugeza, Kib.1-5 wammanga, kilaga enfuna ya omugatto oba omuviiso **E** ogwa vekta **A, B , C** ne **D**.



Kib. 1-5

(4) *Enjawulo* ya vekta **A** ne **B**, ebakilwa **A** - **B**, ye vekta **C** nga bwe gattibwa ku **B** ewa **A.** Kiwendonkana, **A** - **B** esonjolekeka nga **A** +(-**B).**

Singa **A** = **B**, olwo **A** - **B** esonjolebwa nga *vekta zero* ebakilwa **0**. Eno elina obwaguuga bwa zero naye oluyolekelo telusonjolwa.

(5) *Omuzaalo* gwa vekta **A** ne ekidaalafa *p* ye vekta *p***A** oba **A***p* ne obwaguuga emilundi |p| obwaguuga bwa **A** ne oluyolekelo bye bimu oba ebikontana ne ogwo ogwa **A** okusinziila ku *p* nga mpazi oba nga nnghaanyi. Singa *p*= 0, *p***A**= **0**, vekta zero.

To conclude this paper, let the clichéd question "Now, what is the way forward?" be responded to. While the process of exemplifying Luyanja will assuredly continue, two salient tasks present themselves to us. First, a comprehensive reference grammar of Luyanja is in need of codification. Second, we shall undertake compilation of English-Luyanja dictionaries for the basic sciences of logic, mathematics, physics, chemistry, biology and economics.

But the rate of parallel accomplishment of the tasks will be determined by availability of research funding.