A Normalization Technique for Projection Through Mathematical Kcraft

Praveen Kumar Singh[1] and Anupama Jain[2]
[1,2] Sagar Institute of Research and Technology, Bhopal, M.P., India
praveenkumar1by8@gmail.com

Abstract. "Kcraft (craft) Mathematics" is a developed aspect of the personal skills in, geometry, numeracy, trigonometry, and algebra within the creative domain of 3D geometric art. Kcraft Mathematics is the introduction of its own algebraic notation system for mathematical projection, formalizing geometric transformations through symbolic expressions unique to Kcraft's operational principles. This system establishes a new algebraic language that bridges creative geometry and mathematical precision, enabling structured construction and representation of 3D art through mathematical formulation. This is the process of understanding the operation of kcraft through mathematics. In this article, we are proposing three formulas that facilitate coordinate transformation for projection (specific notation)—allowing specific geometric structures to normalize the coordinate for the projection purpose and formalize the coordinates using algebraic notations. This approach provides a foundational mathematical framework for performing and interpreting Kcraft as both an artistic and mathematical discipline.

Keyword: Craft, 3D Geometric Art, Mathematics, Normalization, Formula, Variables.

1. Introduction

Kcraft mathematics also known as craft mathematics is the most interesting and innovative technique. It is a very logical calculation language. If we want to solve logical problems, then we can use kcraft mathematics. This research contains basics to advance in kcraft mathematics. Also, this research makes kcraft mathematics another mathematical language. The context of this research are operators, dependability, standard units which are unified in kcraft, error calculations, a unique type of constant, how to perform calculations and what kind of logic we required to solve kcraft problems. In this paper we first introduce the kcraft then in the second point discuss over available literature and research in this area, third phase gives a detailed idea of the proposed work, the fourth phase

S. Bhalerao et al. (eds.), *Proceedings of the 2nd International Conference on Recent Advancement and Modernization in Sustainable Intelligent Technologies & Applications (RAMSITA-2026)*, Advances in Intelligent Systems Research 207,
https://doi.org/10.2991/978-94-6239-678-4_4

discusses an example to show actual implementation and applications, and finally, in the conclusion, summarize the overall proposed work and future possibilities.

2. Literature Review

Lappan G and R. Even proposed a technique [1] Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In this the development of a new cognitive apprenticeship to teach students the thinking and problem–solving skills involved in school subjects such as reading, writing, and mathematics.

Collins A, J. S. Brown, and S. E. Newman proposed a technique [2] Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In this the development of a new cognitive apprenticeship to teach students the thinking and problem–solving skills involved in school subjects such as reading, writing, and mathematics.

Nimkulrat N and J. Matthews proposed a technique [3] Ways of being strands: Cross-disciplinary collaboration using craft and mathematics in this Mathematical investigation of Nimkulrat's craft knots through mathematical knot diagrams by Matthews revealed knot properties which were indiscernible from the work alone. Eisenberg M et.al proposed a technique [4] Output device, computation, and the future of mathematical crafts. In this, the advent of powerful, affordable output devices offers the potential for a vastly expanded landscape of computationally-enriched mathematical craft activities in education. While mathematical crafts have a venerable history in classrooms.

Saavedra S, R. P. Rohr, J. Bascompte, O. Godoy, N. J. Kraft, and J. M. Levine proposed a technique[5] A structural approach for understanding multispecies coexistence. In this coexistence observed in species-rich communities results from indirect effects among competitors that only emerge in diverse systems remains poorly understood. Randall et.al proposed a technique [6] A very deep Chandra observation of the galaxy group in this system uniquely shows three pairs of collinear cavities, with each pair associated with an unambiguous active galactic nucleus (AGN) outburst shock front.

Kane M. proposed a technique [7] the precision of measurements. In these Standard errors of measurement provide convenient indexes of consistency, but their magnitude depends on the score scale and, therefore, it is difficult to make evaluative judgments about standard errors without having some benchmark for comparison.

Sevinc S proposed a technique [8] Knowledge in action for crafting mathematics problems in realistic contexts in this professional practice of crafting realistic mathematics problems, the prospective teachers identified epistemological supports that blended not only content and pedagogy but also other knowledge dimensions, which have crucial implications for mathematics teacher education.

Nemirovsky B. proposed a technique [9] for the continuities between craft and mathematical practices. In this, the practical engagement with materials and techniques in basketwork has given meaning to geometric relationships.

A. Kamoen, L Dermoût and R Verbeeck proposed a technique [10] for the clinical significance of error measurement in the interpretation of treatment results. In this Fifty cephalograms were randomly selected from patient files and the following were determined. (i) Accuracy of the digitizer. (ii) Intra- and inter- observer digitizing error. (iii) Intra- and inter-observer tracing error.

Wiener N. proposed a technique [11] A new theory of measurement: a study in the logic of mathematics. In this the existence of such non-metrical branches of mathematics as protective and descriptive geometry, the theory of groups, the algebra of logic, &c, prove this notion false, it is nevertheless true that the applications of mathematics have, up to the present time, been, almost without exception, applications of measurement.

H. Wu, M. J. Hayes, D. A. Wilhite, and M. D. Svoboda proposed a technique [12] The effect of the length of record on the standardized precipitation index calculation. In this the index of agreement, and the consistency of dry/wet event categories between SPI values derived from different precipitation record lengths.

Leng M. proposed a technique [13] an “Algebraic” approach to mathematics. In this resulted from the apparent need for infinitary sets in order to provide a proper foundation for mathematical analysis, and was exacerbated by the discovery of both apparent and actual paradoxes in naïve infinitary set theory.

Shaohua Wu, C. T. Lao, J. Akroyd, S. Mosbach, W. Yang, and M. Kraft proposed a technique [14] a joint moment projection method and maximum entropy approach for the simulation of soot formation and oxidation in diesel engines in this. The moment projection method is used to solve the population balance equations and generate moments that are supplied to the maximum entropy approach as a post-processing technique to reconstruct the soot particle size distribution.

Wares A, and I. Elstak proposed a technique [15] of Origami, geometry, and art. In this first construct a simple origami box from a rectangular sheet and then discuss some of the mathematical questions that arise in the context of geometry and algebra.

3. Proposed Work

In this normalization technique, we design some formulas to normalize and transform the coordinators for projection through mathematical kcraft.

3.1 Function/ operators: operator is a symbol or a function that perform from the given inputs. kcraft have some different types of symbols that are used to perform operations as shown in Table 1.

Table 1. Operations and Symbols

Operations	Symbols
Addition	J
Subtraction	R
Multiplication	mJ
Division	dR

The meaning of these symbols are:

J means joining, joining is a type of addition. R means remove, removing is type of subtraction. In mJ, m means multiplication. Multiplying means increasing the main value by some value. In dR, d means division it decreases the main value by some value shown in Table1.

The objects of kcraft are treat like a variable in kcraft mathematics.

3.2. Dependent and independent objects

The need behind for the development of this 'Dependent and independent concept' is kcraft has two operators for the joining of two variables, that are joining and arranging operators. Joining(J)is like a simple addition operator, and joining is an independent operator. Arranging(A) is also a joining operator, but it is dependent operator. Arranging operator is depend on another variable for performing joining operation. So, on which variables J and A are applied. Before it we discuss the concept of accessibility. So, variables are divided into three categories that are acceptors, provider and versatile variables shown in Table 2.

• Acceptor variable/ object: Those variable/ object accept operation from another variable.
• Provider variable/ object: Those variable/ object provider operation from another variable.
• Versatile variable/ object: Those variable/ objects how's the both operation from another variable.

Table 2. Shows behavior of objects.

Acceptor variable	Provider variable	Versatile variable
xB^n, xBp^n	xL^n, xSp^n	xG^n, xN^n

The meaning of these notation/ objects is:

B means Box, Bp means Boxy Pentagon, L means List, Sp means Special Objects, G means Gun (Gun shaped object) and N means Nail. x means size of the object according to A4 size of paper (1, ½, ¼, 1/8, and so on) and n means number of the objects.

So, how we relate variables with operators. If the same category of variable is operated with each other than arranging(A) type of addition operator is used in between them. If both variables are of different category of variables is operated with each other than joining(J) type of addition operator is used in between them. On the using of these two types of operators it doesn't affect the final answer, but the operations are different. Examples:

(1) for joining(J) operator

(2) $xB^2 \rightarrow J \rightarrow xL^1 = xB^2$

(3) for arranging(A) operator $xB^1 \rightarrow A \rightarrow xB^1 = xB^2$

The "→" shows the flow of process.

similarly, we can use addition operators with other remaining variables/ objects.

4. Kcraft standard units

Standard units refer to a set of agreed measures for various kcraft variables/ quantities. Kcraft language have their variable for calculation. But kcraft notation is looks scary if we write variables many times, some time it may confusing. When kcraft language is converted into kcraft mathematics to understand the variation of kcraft. then we convert kcraft variables into standard unit. These standard unit added suffix of the number as shown in Table 3.

Table 3. show the units of kcraft objects.

variable	suffix	variable	suffix
xB^n	b	xN^n	N
xL^n	L	xBp^n	bp
xG^n	G	xSp^n	sp

These suffixes have special meaning assign by kcraft. these suffixes are not involving in any mathematical operations. It doesn't affect any mathematical values. The decimal values are also written with these suffixes.

Now, we take an example to understand the process. $n= xB^{10} + xB^{1/2} – xB^2 + xN^2$(acc. to BCSN) (kcraft variable notation). Now, turns it into kcraft mathematics numbers n= 10b + 0.5b – 2b + 2N. the value of n be same in both the cases.

In the below equations and formulations, you saw we only use b standard notation. Why we use b variable? Because xB^n or b is our standard object or variable in both the kcraft language and kcraft mathematics to perform calculations. Kcraft mathematics have own scale which is made on xB^n format.

5. Measurements and Error calculation

5.1 Mathematical expression for calculating no. of boxes present in any given length.

Let the given length l of the wire. Consider xB^n be the general variable for box. b is the standard unit of representation of box variable in kcraft mathematics.

$xBl^n = kb$ (Eq. 1), where's Bl means box according to its side length, b is standard unit, k=length of n boxes in kcraft mathematics.

b is equal constant; it is a unique variable it is not involved into any mathematical operation. It is only representation part of the box. B denote the box variable.

Formulation for find the number of boxes in the given length n = l/kb– Pk - Eg (Eq. 2) and n' = l/kb (Eq. 3) this formula gives us approx. value.

Where's n= total no. of boxes. n' = assumed or approx. requirement of boxes. kb = length acquired by a box. Eg = excess/ extra gape. Pk, Pr = Praveen's constant. l = the length is given by the user. the value of n' is used in the calculation of Pk constant.

The meaning of the above equation (2) is l/kb gives us assumed/ approximate required number of boxes present in the given length. Pk removes the minimum gap. Eg is the excess gap rather than minimum gap.

5.2 Calculation of Pr or Pk constant:

Pk is the first name of the creator of kcraft. Both the Pr and Pk constant have the same meaning. Pk constant is called variable constant because Pk constant is varies according to kcraft variables that is used in calculation in the Pk constant.

Pk constant is may be added or subtracted. Pk is calculated the default gap or accidental and non-accidental gaps. Kcraft mathematics have two types

1. Kcraft variable numbers (means kcraft mathematics),

2.Mathematics number (normal/ ordinary mathematics).

5.3 Calculation of Pk variable constant.

Firstly, what is the actual length is kcraft mathematics. Actual length is the user given length. Actual length is denoted by l. Assumed length is the length acquired by n number of boxes in the given actual length. assumed length is denoted by l'. Pk constant is the intermediate gaps between two consecutive boxes till the end boxes. If n number of boxes involve so n-1 gaps is formed.

So, actual length= assumed length + Pk constant. Therefore l = l' + Pk (Eq. 4).

l' = nkb where's n=no. of boxes presents in the given length, kb= k be having some length value and b stands for standard unit of representation in kcraft, b is only used for representation it is not involves in any mathematical operations or it did not affect any mathematical operations. Now, we understand the process of l'=nkb. n be the no. of boxes; it means the l' be in the form of kcraft variable. On multiply the n by kb it turns l' be in mathematical numbers. So, l'=nkb gives values in mathematical numbers.

Now, Pk'=(n-1) g' where's n-1 is no. of gaps formed, g'= initial/ default/ minimum gap constant (g'=0.1cm). we get n-1 and g' be mathematical numbers. So, Pk' gives mathematical values. Why we use Pk' here because Pk originally belongs to kcraft mathematics (or we can say that Pk is the variable of kcraft mathematics). Now, Pk values in kcraft variable number. So, Pk = Pk'/kb. On dividing Pk' by kb it turns mathematical numbers into kcraft variable numbers. Now, Pk = ((n-1) g')/kb (Eq. 5).

l = nkb+ (n-1) g' {in mathematical numbers} (Eq. 6)

l = n + ((n-1) g')/kb {in kcraft variable no.'s} (Eq. 7)

Case 1: Pk constant is used to calculated the default gaps.

There is g' will always be equal to 0.1cm. all the further operations is followed same as previous operation is takes place.

Case 2: Pk constant is used to calculate the accidental gaps.

It is the same as case 1. There is g' will always be equal to 0.1cm. all the further operations are followed same as the previous operation is taking place.

Case 3: Pk constant is used to calculate the non-accidental gaps.

This case is differed from the above two cases. In this, the value of g' is greater than

0.1cm. and how much greater is not defined. But the value of g' varies between 0.1cm to 0.5cm. (0.1>g'<0.5). in your mind a, question is arisen from where the value of g' is come from. The value of g' be calculated by the efficiency of the person who makes this model/ object. 5.4 Calculation of efficiency

g' = average efficiency of a person. The value of g' is differ by time and practice. So, how do we calculate the average efficiency of a person? In a single series of arrangements of boxes. Let a condition a list consists of 30 boxes. Mark the list into some no. of parts example six parts each part contains five boxes and five parts each part contains six boxes. Before this process you make a spiral of the initial ring containing five boxes, then open it and do the marking process. Take the first part and med it P1, similarly named all the remaining parts to be P2, P3, P4, P5, P6.

Now, Pn= (the length covered by the no. of items consisting in this part measured by ruler scale) – (sum of the length of each item present in this part measured by ruler scale). Where Pn= P denotes parts and n denotes which part you choose. The process is the same for all the parts. Now, Pn decides your efficiency. So, g' be the average of the efficiency.

g' = (sum of all the Pn)/n, g' = (P1+P2+P3+P4+P5+P6)/6 now, the value of g' is come from the above formulation then, put it in the Pk variable constant. So, the non-accidental gap is arisen in the length is include by Pk
constant.

6. Implementation

6.1 How to implement above formulation?

• If length is given then how we calculate the no. of boxes present in the given length.

• If no. of boxes is given then how we find the length required to contain these boxes.

What we have? n = l/kb – Pk –Eg and n' = l/kb from Eq. 2 and Eq. 3 all the calculation depends on your n' value.

Case 1: if the value of n' be in perfect no. or perfect natural no. then, the same value of n' is taken for Pk constant calculation.

Case 2: if the value of n' be in the format of n.d means n= natural no. and d= decimal number. The value of d is less than 0.5. Then n' is divided in two parts n1' and n2'.

i.e., n'= n1' + n2'. Where n1' consists natural number (n1' = n) and n2' consists decimal number (n2' = d). so, n'= n1' + n2'. The value of n1' is used for Pk calculation. If Eg is not given in the question then, neglect the Eg from the formula. Now, n=n1' + n2' – Pk. (or n=n1' + d – Pk.) the value of n is in the format of kcraft variable mathematics.

Case 3: if the value of n' be in the format of n.d. the value of d is lies 0.5 to 0.99. the value is divided into two parts n1'. d and n2'. The value of n1'. d means n1'.5. so, n'= n1'. d + n2'. The value of n1'. d is used for Pk constant. When we calculate the Pk constant take only the n1' part from the n1'.

d. the (n-1) part take as (n1'+1). So, the formula of PK be ((n1' + 1) g')/kb (Eq. 8).

The format of write any value in kcraft mathematics with its Pk constant if it is available. means if any value is like this 7b with gap error of 0.366. so, we write these above kcraft numbers in the format of n= 7b and Pk= 0.366b.

Now we take a question and perform the above operations and confirm that the equation/ formulation is true or not.

First, we take all equations. n = l/kb – Pk – Eg and n' = l/kb (From Eq.2 and 3)

l = nkb+ (n-1) g' {in mathematical numbers} (From Eq. 6)

l = n + ((n-1) g')/kb {in kcraft variable no.'s} (From Eq. 7)

now take a situation where the length of n boxes is given. Let l= 15cm. now firstly we calculate the n'= l/kb. The given value of kb= 1.8cm. now, n'= l/kb= 15/1.8= 8.333 now we divide n' in natural and decimal part and name them. Then, n1'= 8 and n2'=0.333. now, calculate the Pk constant by taking the value of n=n1' in the Pk equation. Pk= ((n-1) g')/kb

= ((n1'-1) g')/kb. (From Eq. 8). The value of g'=0.1 is the standard value. Now, Pk= ((8-1)0.1)/1.8 = 0.388. so, the value of n = n' – Pk (Eg is neglect because the value of Eg is not given).
n= 8.333 – 0.388 = 7.945. now, value be n= 7.945b and Pk= 0.388b. so, finally we calculate the value of n with its gap error.

Now, we take same value of n= 7.945b and Pk= 0.388b and find the actual length covered by n. now, we find the actual length you can see in the above lines the value of n and Pk is in the format of kcraft numbers. Now l = n + Pk = 7.945b + 0.388b = 8.333b. so, we find the length in normal mathematical format l = nkb + Pk' (Pk= Pk'/kb = Pk'= Pk. kb), now l = nkb + Pk.kb. now take kb be common out, so l = (n + Pk) kb. Now, l= (7.945 + 0.388)1.8 = (8.333)1.8 = 14.9994cm which is approx. equal to 15 cm.

Now, we can validate the case 3. Let the given length l= 16cm. the calculation of n'=l/kb i.e., n'=16/1.8 = 8.888. now n'=n1'. d +n2'. Thus, n1'. d=8.5 and n2'=0.388. the calculation of Pk= ((n1' + 1) g')/kb. (From Eq. 8). i.e., Pk= ((8+1)0.1)/1.8 = 0.5. the value of n=n1'. d + n2' – Pk. So, n= 8.5 + 0.388 – 0.5 = 8.388.
now the value be n=8.388b and Pk=0.5b. now, we apply length formula to verify this value. Now we directly use mathematical number formula l= nkb + Pk' (from Eq. 6). where, Pk'=Pk.kb so, l= (n + Pk) kb this means l= (8.388+ 0.5)1.8 = 15.998 cm i.e., approximately equal to 16cm.

7. Conclusion

We proposed a new and unique approach in kcraft mathematics. In this we turned mathematics in this way it can be applicable on the kcraft. We develop step-by-step instructions to turn kcraft variable notations into mathematical numbers. In this research we get two ways that we can write kcraft mathematics (represent Eq. 6) kcraft variable numbers, and (Represents Eq. 7) normal mathematical numbers. The set of instruction used for writing kcraft variable numbers in the topic no.4 (kcraft standard units). We have developed the concept of dependence and independence that is applicable in kcraft variable numbers. we have developed error solving techniques that are arises between calculation of any length. Form this error calculation we understood the behavior of kcraft mathematics. We take examples to verify the calculation of measurement and error calculation formulas and techniques of performing these calculation processes.

References

1. Lappan, Glenda, and Ruhama Even. "Learning To Teach: Constructing Meaningful Understanding of Mathematical Content. Craft Paper 89-3." (1989).
2. Collins, Allan, John Seely Brown, and Susan E. Newman. "Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics." In *Knowing, learning, and instruction*, pp. 453-494. Routledge, 2018.
3. N. Nimkulrat and J. Matthews, "Ways of being strands: Cross-disciplinary collaboration using craft and mathematics," *Design Issues* **33**(4), 59–72 (2017).
4. M. Eisenberg, "Output devices, computation, and the future of mathematical crafts," *Int. J. Comput. Math. Learn.* **7**, 1–44 (2002).
5. S. Saavedra, R. P. Rohr, J. Bascompte, O. Godoy, N. J. Kraft, and J. M. Levine, "A structural approach for understanding multispecies coexistence," *Ecol. Monogr.* **87**(3), 470–486 (2017).
6. S. W. Randall, P. E. J. Nulsen, C. Jones, W. R. Forman, E. Bulbul, and T. E. Clarke, *Astrophysical studies of galaxy clusters*.
7. R. Kraft, E. L. Blanton, L. David, N. Werner, and M. Sun, "A very deep Chandra observation of the galaxy group NGC 5813: AGN shocks, feedback, and outburst history," *Astrophys. J.* **805**(2), 112 (2015).
8. M. Kane, "The precision of measurements," *Appl. Meas. Educ.* **9**(4), 355–379 (1996).
9. S. Sevinc, "Knowledge-in-action for crafting mathematics problems in realistic contexts," *J. Math. Teach. Educ.* **25**, 1–33 (2022).
10. Nemirovsky, Benjamin. "On the continuities between craft and mathematical practices." (2020).
11. A. Kamoen, L Dermoût and R Verbeeck "The clinical significance of error measurement in the interpretation of treatment results," *Eur. J. Orthod.* **23**(5), 569–578 (2001).
12. N. Wiener, "A new theory of measurement: A study in the logic of mathematics," *Proc. Lond. Math. Soc.* **2**(1), 181–205 (1921).
13. H. Wu, M. J. Hayes, D. A. Wilhite, and M. D. Svoboda, "The effect of the length of record on the standardized precipitation index calculation," *Int. J. Climatol.* **25**(4), 505–520 (2005).
14. M. Leng, *Algebraic Approaches to Mathematics* (Palgrave Macmillan, London, 2009).
15. S. Wu, C. T. Lao, J. Akroyd, S. Mosbach, W. Yang, and M. Kraft, "A joint moment projection method and maximum entropy approach for simulation of soot formation and oxidation in diesel engines," *Appl. Energy* **258**, 114083 (2020).
16. A. Wares and I. Elstak, "Origami, geometry and art," *Int. J. Math. Educ. Sci. Technol.* **48**(2), 317–324 (2017).