Frieze Group in Generating Traditional Cloth Motifs of the East Nusa Tenggara Province

by Yessica Nataliani

Submission date: 27-Apr-2022 01:49PM (UTC+0700)
Submission ID: 1821666517
File name: submit_JTAM2.docx (2.08M)
Word count: 3213
Character count: 16969

JTAM (Jurnal Teori dan Aplikasi Matematika)
http://journal.ummat.ac.id/index.php/jtam
p-ISSN 2597-7512 | e-ISSN 2614-1175
Vol. X, No. Y, Month 20XX, pp. XX-YY

Frieze Group in Generating Traditional Cloth Motifs of the East Nusa Tenggara Province

Yessica Nataliani
Faculty of Information Technology, Satya Wacana Christian University, Indonesia
yessica.nataliani@uksw.edu

Article History:
Received : D-M-20XX
Revised : D-M-20XX
Accepted : D-M-20XX
Online : D-M-20XX

Keyword:
Frieze group;
Traditional cloth motifs;
Tenun ikat;
East Nusa Tenggara;
Motif generation.

ABSTRACT

Ethnomathematics studies the relationship between mathematics and culture. Indonesia has many traditional cultures. One of them is traditional cloth. The traditional cloth from East Nusa Tenggara (NTT) province is called tenun ikat. Since the motif of tenun ikat consists of symmetrical and repeated patterns, it can be generated using Frieze groups. The Frieze groups are the plane symmetry groups of patterns whose subgroups of translations are isomorphic to $\mathbb{Z}$. There are seven groups in the Frieze groups, i.e., $F_1, F_2, F_3, F_4, F_5, F_6$, and F_7. Translation, reflection, rotation, and glide reflection are the transformation used in the Frieze groups. In this paper, three motifs of tenun ikat are presented to demonstrate the implementation of Frieze groups. Furthermore, a GUI Matlab program is developed to generate the Frieze groups. Since one motif of tenun ikat may consist of some basic patterns, the basic patterns are identified first, and then each of them is generated into the desired pattern, according to the suitable Frieze groups. With the Frieze group, users can generate other patterns from a basic pattern, so users can generate new motifs of tenun ikat without leaving the cultural characteristics of NTT province.

https://doi.org/10.31764/jtam.vXiY.ZZZ

---------- ◆ ----------

A. INTRODUCTION

Repeated patterns are often encountered in everyday life, for example in cloth, woven bamboo, paving roads, tiles, wall ornaments, etc. The repeated pattern is basically formed from a pattern that is transformed in such a way, so that it forms a unified pattern. Four lines can form a square, six equilateral triangles combine into a hexagon, some honeycombs can be combined into hexagons, and the right footprint and left footprint can form a pair of footprints. The repeating pattern is symmetric. A square is symmetric, right and left, top and bottom have the same size. Likewise with the footprints, right and left must be symmetrical. Other examples that have symmetrical properties include butterflies, scissors, and even the human body is symmetrical.

Indonesia is a country consisting of various cultures. Each culture has different characteristics, which can be seen and reflected in the local language, traditional cloth, traditional weapons, folk songs, local dances, traditional ceremonies, etc. Especially for traditional cloth, each province in Indonesia has a different motif. Traditional clothes describe various ethnic, religions, and social classes.

Tenun ikat is a traditional cloth of several regions in the East Nusa Tenggara (NTT) province, such as Flores, Sumba, Timor, Alor, Rote, and Sawu. Tenun ikat is typically used for clothing in everyday life, clothing in traditional dances or ceremonies, dowry in marriage, an indicator of social status, transaction tools, and a gift (Nainupu, 2018). It is made by weaving threads and making the motif by tying it with a rope according to a particular pattern before being dipped in dye. Tenun ikat from 22 regions in NTT province has various motif designs, colors, and sizes, representing their characteristics. The motifs are related to the customs, beliefs, culture, and habits of the local community (Maghiszha, 2019). Tenun ikat from Sumba and Rote regions generally use animal and leaf motifs, respectively. Tenun ikat from Timor region is in the form of silk and has embroidery. Alor region uses natural colors from plants and marine life (Salma et al., 2018). Some motifs of tenun ikat are shown in Figure 1.

Figure 1. Some Traditional Cloth Motifs of the East Nusa Tenggara, (a) Flores; (b) Sawu; (c) East Sumba; (d) Ende

Weaving the tenun ikat becomes a part of the daily life of people in NTT province, especially women. In this modern era, tenun ikat is not only used by the people of NTT province, but also by people outside of NTT province. Tenun ikat has even appeared at Culture New York Fashion Week in 2017 and Paris Fashion Week in 2018 (PI, 2021). Some problems in the weaving process of tenun ikat are the expensive materials and long processing times (Administrator, 2019), which made the price of tenun ikat expensive. Furthermore, some of the younger generations do not want to continue the weaving culture. This can lead to the extinction of the tenun ikat culture. With the advancement of technology, tenun ikat, specifically, its motifs, can be preserved or maintained even developed further. Motifs of tenun ikat can be generated using mathematical formulas and digitized using a computer program.

From Figure 1, it can be seen that the motif of tenun ikat has the characteristic of a geometric pattern. A geometric pattern is a design with a certain pattern, repeating regularly. Ethnomathematics is the study of the relationship between mathematics and culture. Some motifs in the tenun ikat can be generated by applying mathematical formulas. One of the mathematical formulas that can be applied is crystallographic patterns. Some research about finding the crystallographic patterns for traditional clothes can be found in (De Las Peñas et al., 2018; Hobanthad & Prajonsant, 2021; Kartika et al., 2022; Libo-On, 2019; Vasquez et al., 2020).

Another mathematical formula that can be used is Frieze groups (Davvaz, 2021). Frieze groups aim to design some repetitions in one dimension, into decorative arts. Some research using Frieze groups concerning culture are shown in Table 1.

Table 1. Research about Frieze Groups

No	Title	Result
1	Frieze Patterns on Papua Batik (Nggumbe et al., 2018)	In one motif of Papua batik, there are several Frieze patterns.
2	Frieze Groups on Saman Dance (Oktavianto et al., 2018)	In Saman dance, there are two Frieze groups, i.e., F_1 and F_3.

No	Title	Result
3	Frieze Groups on Mosque Decorative Arts (Rahmawati et al., 2018)	Not all patterns in mosque decorative arts can be classified into seven Frieze patterns and not all seven frieze patterns always exist in one mosque decorative arts.
4	Symmetry Patterns: An Analysis on Frieze Patterns in Malay Telepuk Fabric (Abdullah et al., 2019)	It is proven that there are geometrical and symmetrical patterns in the Telepuk fabric.
5	Crystallographic and Frieze Groups Structures in Hablon (Libo-On, 2019)	All Frieze patterns are clearly visible in Hablon.
6	Frieze Group Pattern in Buyung Dance Formation (Andriani et al., 2020)	The formations of Buyung dance are identical to the Frieze group patterns.
7	Exploring Motifs in Towe Songke, Manggaraian Ethnic Woven Fabric, in Mathematics Perspective (Makur et al., 2020)	Most motifs in Towe Songke have group F_7 because they can be seen as translation, horizontal reflection, vertical reflection and half turn rotation symmetry.
8	One-color Frieze Patterns in Friendship Bracelets: A Cross-Cultural Comparison (Koss, 2021)	Users are creating designs based on symmetry preferences of their local culture.
9	Analysis of Frieze Patterns Concepts in Pua Kumbu (Truna et al., 2021)	Patterns based on geometry and symmetry exist in the ways Pua Kumbu is created.
10	Korean Traditional Patterns: Frieze and Wallpaper (Shin et al., 2021)	Two Korean traditional music instruments play the seven frieze patterns.
11	Frieze Pattern on Shibori Fabric (Puspasari et al., 2022)	There are Frieze patterns in the Shibori motif, i.e., F_1, F_2, F_3, F_4, F_5, F_6, and F_7.
12	Analysis of Frieze and Crystallographic Patterns of North Sumatran Malay Songket Textile (Kartika et al., 2022)	Four Frieze patterns can be recognized on the North Sumatran Malay songket textile, i.e., F_1, F_3, F_5, and F_7.

The goal of this paper is to explore the mathematical ideas, especially geometry elements in motifs produced in the motifs of tenun ikat using Frieze groups. Furthermore, a computer program is made to generate the motif from a basic pattern, so users can generate new motifs of tenun ikat without leaving the cultural characteristics of NTT province.

B. METHODS

In this paper, Frieze groups are used to identify and generate the basic pattern of tenun ikat. The Frieze groups are the plane symmetry groups of patterns whose subgroups of translations are isomorphic to $\mathbb{Z}$. Transformation used in the Frieze group can be seen below. Let $\begin{pmatrix} a \\ b \end{pmatrix}$ be the origin point and $\begin{pmatrix} a' \\ b' \end{pmatrix}$ be the result point.

1. Translation. The matrix transformation for translation is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} a+h \\ b+k \end{pmatrix}$.
2. Reflection. The matrix transformation for vertical reflection at $x = 0$ is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}$, while at $x = h$ is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} 2h \\ 0 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}$. The matrix transformation for horizontal reflection at $y = 0$ is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}$, while at $y = k$ is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} 0 \\ 2k \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}$.
3. Rotation. The matrix transformation for rotation at $(0,0)$ is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}$, while the matrix transformation at (m,n) is $\begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix}\begin{pmatrix} a-m \\ b-n \end{pmatrix} + \begin{pmatrix} m \\ n \end{pmatrix}$.

Rotations can be rotations of orders two, three, four, and six-fold, where the angle of rotations is 180°, 120°, 90°, and 60°, respectively.

4. Glide reflection. Glide reflection is transformation for both translation and reflection.

There are seven patterns in the Frieze groups, as shown in Table 2 (Gallian, 2015).

Table 2. Frieze Group

Group	Symbol	Formula	Description
F_1 (hop)	11	$F_1 = \{x^n \mid n \in \mathbb{Z}\}$, where: x : translation	Translation in horizontal directions
F_2 (step)	1g	$F_2 = \{x^n \mid n \in \mathbb{Z}\}$, where: x : glide reflection	Glide reflection
F_3 (sidle)	m1	$F_3 = \{x^n y^m \mid n \in \mathbb{Z}, m = 0$ or $m = 1\}$, where: x : translation y : vertical reflection	Translation and vertical reflection
F_4 (spinning hop)	12	$F_4 = \{x^n y^m \mid n \in \mathbb{Z}, m = 0$ or $m = 1\}$, where: x : translation y : rotation of 180°	Translation and two-fold rotation
F_5 (spinning sidle)	mg	$F_5 = \{x^n y^m \mid n \in \mathbb{Z}, m = 0$ or $m = 1\}$, where: x : glide reflection y : rotation of 180°	Glide reflection and two-fold rotation
F_6 (jump)	1m	$F_6 = \{x^n y^m \mid n \in \mathbb{Z}, m = 0$ or $m = 1\}$, where: x : translation y : horizontal reflection	Translation and horizontal reflection
F_7 (spinning jump)	mm	$F_7 = \{x^n y^m z^k \mid n \in \mathbb{Z}, m = 0$ or $m = 1$, $k = 0$ or $k = 1\}$, where: x : translation y : horizontal reflection z : vertical reflection	Translation, horizontal and vertical reflection

Washburn and Crowe (1988) proposed an algorithm that can be used to identify seven Frieze groups by using flowchart, as seen in Figure 2 (Gallian, 2015).

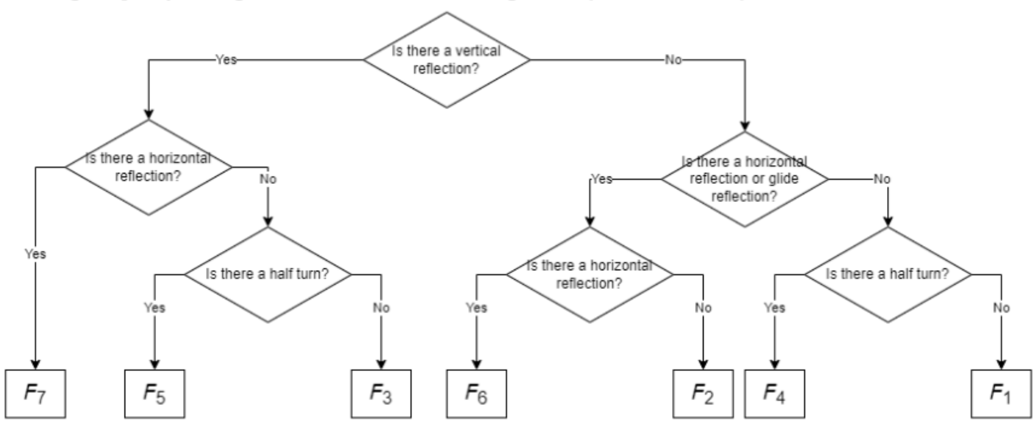


Figure 2. Flowchart for Identifying Frieze Groups

For example, one basic pattern shown in Figure 3 is used. From this basic pattern, the seven patterns of Frieze groups can be generated as shown in Figures 4-10.

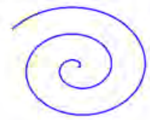


Figure 3. Basic Pattern

1. Group F_1. Let x denotes a translation to the right of one unit, then the group F_1 is generated as shown in Figure 4.

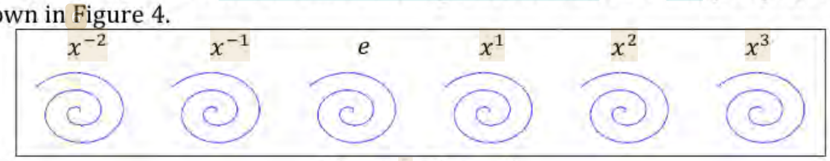


Figure 4. Group F_1

2. Group F_2. Let x denotes a glide reflection, then the group F_2 is generated as shown in Figure 5.

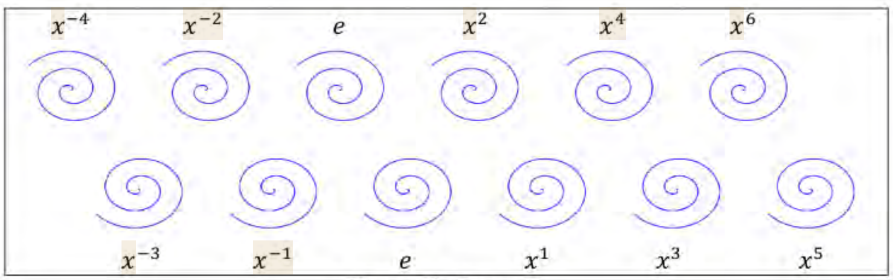


Figure 5. Group F_2

3. Group F_3. Let x denotes a translation to the right of one unit and y denotes a vertical reflection, then the group F_3 is generated as shown in Figure 6.

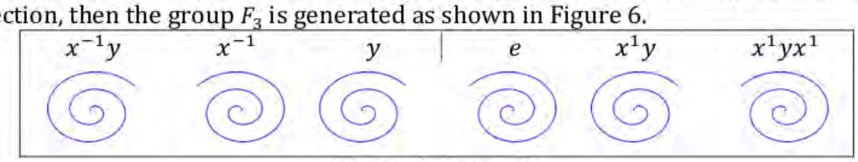


Figure 6. Group F_3

4. Group F_4. Let x denotes a translation to the right of one unit and y denotes a rotation of 180^o, then the group F_4 is generated as shown in Figure 7.

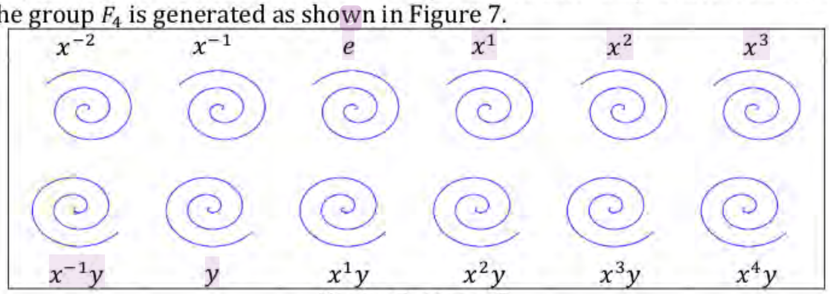


Figure 7. Group F_4

5. Group F_5. Let x denotes a glide reflection and y denotes a rotation of 180°, then the group F_5 is generated as shown in Figure 8.

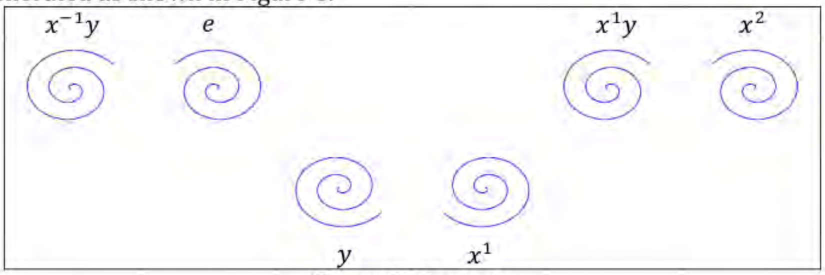


Figure 8. Group F_5

6. Group F_6. Let x denotes a translation to the right of one unit and y denotes a horizontal reflection, then the group F_6 is generated as shown in Figure 9.

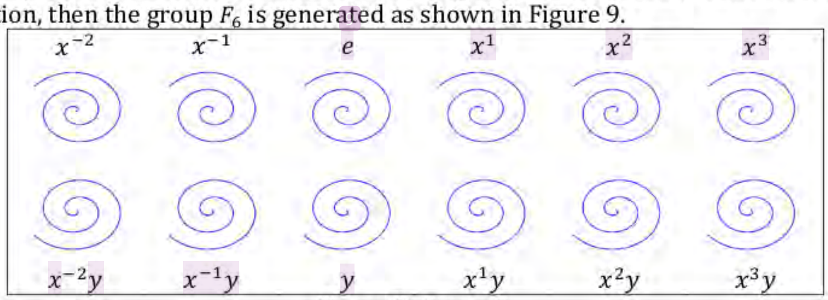


Figure 9. Group F_6

7. Group F_7. Let x denotes a translation to the right of one unit, y denotes a horizontal reflection, and z denotes a vertical reflection, then the group F_7 is generated as shown in Figure 10.

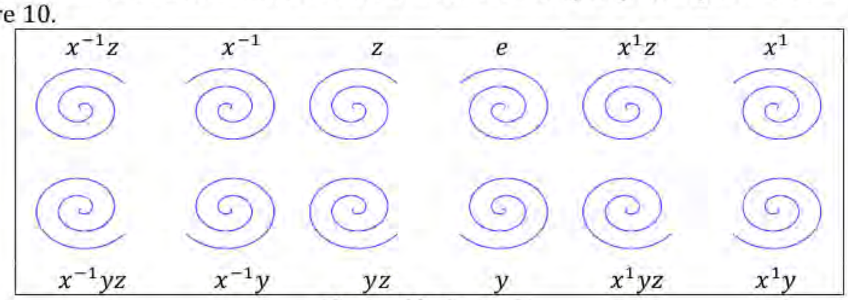


Figure 10. Group F_7

C. RESULT AND DISCUSSION

Several tasks carried out in this article are (1) identifying the basic pattern of tenun ikat, (2) generating a pattern from the basic pattern using Frieze groups, (3) applying a pattern generation using Matlab. In this study, three motifs of tenun ikat from NTT province are used, which can be explained as follows.

1. Motif 1

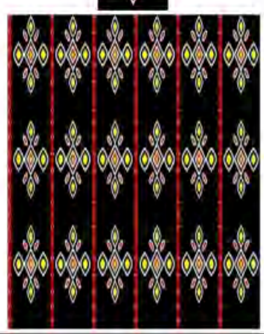
The original motif is shown in Figure 11(a). The motif generation can be seen in Table 3 and the result using the program is shown in Figure 11(b).

(a) (b)

Figure 11. Motif 1 (a) Original; (b) Result from Program Generation

The generation using the Frieze group is described in Table 4. The basic pattern 1 is identified from the result pattern 1 using the flowchart in Figure 3. From the flowchart, the result pattern 1 belongs to the group F_7, where the basic pattern 1 is reflected horizontally, and then translated with vertical reflection, and also translated with vertical and horizontal reflections. Furthermore, the basic pattern 2 generates the result pattern 2 with group F_6, where the basic pattern 2 is translated and reflected vertically.

Table 3. The Generation of Motif 1

No.	Basic Pattern	Group	Result Pattern
1.		F_7	
2.		F_6	

2. Motif 2

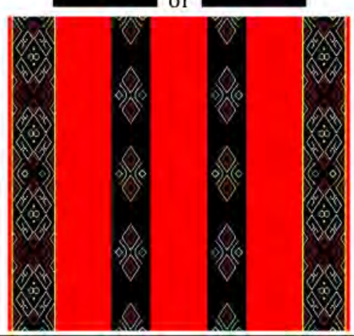
The original motif is shown in Figure 12(a). The motif generation can be seen in Table 4 and the result using the program is shown in Figure 12(b). As seen in Table 4, the motif in Figure 12(a) consists of two parts, the first part as shown in the first row and the second part as shown in the second row. The final result is obtained by combining the two parts, as shown in the third row.

(a) (b)

Figure 12. Motif 2 (a) Original; (b) Result from Program Generation

For the first part, the result pattern 1 can be obtained from the basic pattern 1 by generating group F_7. The second part is generated from the basic pattern 2 using group F_7. Furthermore, the first part and the second part are combined, becoming the basic pattern 3. Using group F_7, the result is shown in the result pattern 3.

Table 4. The Generation of Motif 2

No.	Basic Pattern	Group	Result Pattern
1.		F_7	
2.		F_7	 or 
3.		F_7	

3. Motif 3

The original motif is shown in Figure 13(a). The motif generation can be seen in Table 5 and the result using the program is shown in Figure 13(b). As seen in Table 5, the motif in Figure 13(a) consists of two parts, the first part as shown in the first row and the second part as shown in the second row. The final result is obtained by combining the two parts, as shown in the third row.

(a) (b)

Figure 13. Motif 2 (a) Original; (b) Result from Program Generation

For the first part, the result pattern 1 can be obtained from the basic pattern 1 by generating group F_1. The second part is generated from the basic pattern 2 using group F_7. Furthermore, the first part and the second part are combined, becoming the basic pattern 3. Using group F_3, the result is shown in the result pattern 3.

Table 5. The Generation of Motif 3

No.	Basic Pattern	Group	Result Pattern
1.		F_1	
2.		F_7	
3.		F_3	

Furthermore, Graphical User Interface (GUI) in Matlab is used to generate the pattern. Figure 14 is the GUI design for the pattern generation. Users can enter a motif and choose one Frieze group, as shown in Figure 15(a) and the result can be seen in Figure 15(b).

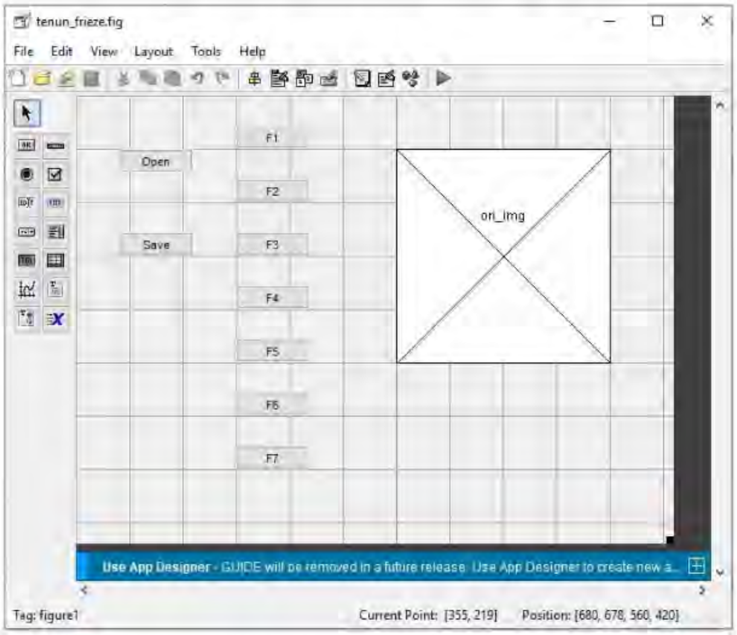


Figure 14. GUI Matlab Design for Generating Frieze Patterns

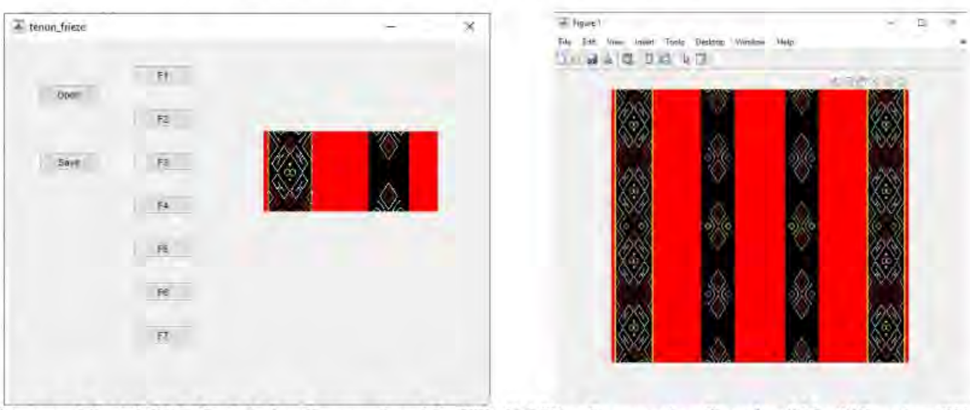


Figure 15. (a) GUI Matlab for Generating Motif 2; (b) The Generating Result of Motif 2 using GUI Matlab

D. CONCLUSION AND SUGGESTIONS

Ethnomathematics combines mathematics and culture. In this paper, the motifs of traditional cloth from NTT province are generated using mathematical formula, i.e., Frieze groups. Three motifs are presented. Each motif consists of some basic patterns. The basic patterns are identified and then generated into the desired pattern using Frieze groups. Furthermore, a GUI Matlab is developed to generate Frieze groups. For future research, the group identification will be conducted using Convolutional Neural Network.

REFERENCES

Abdullah, N., Salleh, N. S. M., Arif, H. A., Noor, A. I. M., & Omar, J. (2019). Symmetry Patterns: An Analysis on Frieze Patterns in Malay Telepuk Fabric. *International Journal of Technical Vocational and Engineering Technology*, *1*(1), 38–45.

Administrator. (2019). *Tenun NTT, Harta Keluarga yang Bernilai Tinggi*. https://www.indonesia.go.id/ragam/budaya/kebudayaan/tenun-ntt-harta-keluarga-yang-bernilai-tinggi

Andriani, L., Muchyidin, A., & Raharjo, H. (2020). Frieze Group Pattern in Buyung Dance Formation. *EduMa: Mathematics Education Learning and Teaching*, *9*(2), 11–24. https://doi.org/10.24235/eduma.v9i2.6960

Davvaz, B. (2021). Frieze and Wallpaper Symmetry Groups. In *Groups and Symmetry* (pp. 179–212). Springer, Singapore. https://doi.org/10.1007/978-981-16-6108-2_9

De Las Peñas, M. L. A. N., Garciano, A., Verzosa, D. M., & Taganap, E. (2018). Crystallographic Patterns in Philippine Indigenous Textiles. *Journal of Applied Crystallography*, *51*(2), 456–469. https://doi.org/10.1107/S1600576718002182

Gallian, J. A. (2015). *Contemporary Abstract Algebra* (9th ed.). Cengage Learning.

Hobanthad, S., & Prajonsant, S. (2021). Application of Wallpaper Group p6m to Creation of Handwoven Mudmee Silk Patterns. *Mathematical Journal*, *66*(704), 7–25.

Kartika, D., Suwanto, F. R., Niska, D. Y., & Ilmiyah, N. F. (2022). Analysis of Frieze and Crystallographic Patterns of North Sumatran Malay Songket Textile. *Journal of Physics: Conference Series*, *2193*, 1–9.

Koss, L. (2021). One-color Frieze Patterns in Friendship Bracelets: A Cross-Cultural Comparison. *Bridges*, *October*, 253–256.

Libo-On, J. T. (2019). Crystallographic and Frieze Groups Structures in Hablon. *International Journal of Advance Study and Research Work*, *2*(5), 25–36. https://doi.org/10.5281/zenodo.3236439

Maghiszha, D. F. (2019). *Mengenal Tenun Ikat Khas NTT, Sejarah hingga Proses Pembuatannya*. https://www.tribunnewswiki.com/2019/12/30/mengenal-tenun-ikat-khas-ntt-sejarah-hingga-proses-pembuatannya

Makur, A. P., Gunur, B., & Rampung, B. (2020). Exploring Motifs in Towe Songke, Manggaraian Ethnic Woven Fabric, in Mathematics Perspective. *SJME (Supremum Journal of Mathematics Education)*, *4*(2), 124–133. https://doi.org/10.35706/sjme.v4i2.3457

Nainupu, J. S. (2018). *Museum Tenun Ikat Provinsi Nusa Tenggara Timur*. Universitas Kristen Duta Wacana.

Nggumbe, C. L. B. P., Mayasari, K., & Jamco, T. H. M. (2018). Pola Frieze pada Batik Papua. *Seminar Nasional Matematika Dan Pendidikan Matematika*, 44–49.

Oktavianto, R. G., Ratnasari, R. R. L. H., & Puspitasari, A. D. (2018). Frieze Group dalam Tari Saman. *Seminar Nasional Matematika Dan Pendidikan Matematika*, 72–77.

PI, R. (2021). *Kain Tenun Ikat khas NTT: Kain Kuno Bernilai Tinggi*. https://pariwisataindonesia.id/headlines/kain-tenun-ikat-khas-ntt/

Puspasari, R., Hartanto, S., Gufron, M., Wijayanti, P., & Budiarto, M. T. (2022). Frieze Pattern on Shibori Fabric. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *6*(1), 67–78. https://doi.org/10.31331/MEDIVESVETERAN.V6I1.1904

Rahmawati, A., Helmi, H., & Fran, F. (2018). Frieze Group pada Seni Dekoratif Mesjid. *Buletin Ilmiah Math, Stat, Dan Terapannya*, *7*(1), 23–32. https://doi.org/10.26418/bbimst.v7i1.23583

Salma, I. R., Syabana, D. K., Satria, Y., & Cristianto, R. (2018). Diversifikasi Desain Produk Tenun Ikat Nusa Tenggara Timur dengan Paduan Teknik Tenun dan Teknik Batik. *Dinamika Kerajinan Dan Batik: Majalah Ilmiah*, *35*(2), 85–94. https://doi.org/10.22322/dkb.v35i2.4174

Shin, H., Sheen, S., Kwon, H., & Mun, T. (2021). Korean Traditional Patterns: Frieze and Wallpaper. *Handbook of the Mathematics of the Arts and Sciences*, 649–664. https://doi.org/10.1007/978-3-319-57072-3_17

Truna, L. A., Tugang, N. B., Shaipullah, N. C. M., & Mahyan, N. R. D. (2021). Analysis of Frieze Patterns Concepts in Pua Kumbu. *Natural Volatiles & Esential Oils*, *8*(4), 10949–10962.

Vasquez, R. S., Valera, N. B., & Zales, J. P. (2020). Crystallographic Pattern Analysis of the Loom Woven Clothes of Abra. *International Journal of Innovation, Creativity and Change*, *14*(3), 353–381.

Frieze Group in Generating Traditional Cloth Motifs of the East Nusa Tenggara Province

ORIGINALITY REPORT

15%	12%	10%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	journal.ummat.ac.id Internet Source	3%
2	D Kartika, F R Suwanto, D Y Niska, N F Ilmiyah. "Analysis of frieze and crystallographic patterns of North Sumatran Malay songket textile", Journal of Physics: Conference Series, 2022 Publication	3%
3	nveo.org Internet Source	2%
4	diamond.boisestate.edu Internet Source	2%
5	www.sciencegate.app Internet Source	1%
6	hal.archives-ouvertes.fr Internet Source	1%
7	download.garuda.kemdikbud.go.id Internet Source	1%

8	jurnal.umpwr.ac.id Internet Source	1 %
9	homepages.dias.ie Internet Source	1 %
10	irjponline.com Internet Source	1 %
11	iopscience.iop.org Internet Source	<1 %
12	e-journal.ivet.ac.id Internet Source	<1 %
13	link.springer.com Internet Source	<1 %
14	pariwisataindonesia.id Internet Source	<1 %
15	docslide.us Internet Source	<1 %
16	Hyunyong Shin, Shilla Sheen, Hyeyoun Kwon, Taeseon Mun. "Chapter 17 Korean Traditional Patterns: Frieze and Wallpaper", Springer Science and Business Media LLC, 2021 Publication	<1 %
17	Ratih Puspasari, Setyo Hartanto, Mohamad Gufron, Pradnyo Wijayanti, Mega Teguh Budiarto. "Frieze Pattern on Shibori Fabric",	<1 %

Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang, 2022

Publication

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

Frieze Group in Generating Traditional Cloth Motifs of the East Nusa Tenggara Province

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11