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BATIK MOTIFS FROM WAVE EQUATIONS WITH VARIATIONS OF NEUMANN BOUNDARY CONDITIONS

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Abstract

The wave batik motif is developed from the mathematical equation of moving waves. This equation consists of two independent variables, namely distance and time. The philosophical meaning of moving waves is that a person's life journey always changes and moves according to life goals. The second philosophical meaning is that a person must always move forward in life, face challenges, and achieve the potential that we have with strength and determination. Neumann's boundary conditions are boundary conditions developed by Neumann. The philosophical meaning of Neumann's boundary conditions is firmness, order, and balance in living life. The second philosophical meaning of Neumann's boundary conditions is solid and steadfast in our lives. The philosophical meaning of moving waves with Neumann's boundary conditions is firmness and openness to change.

Keywords: Batik motifs, moving waves, philosophical meaning, Neumann boundary conditions.

1. INTRODUCTION

Batik Gelombang is an artwork depicting the fascinating explorative journey of the mathematical equation of waves. Focusing on the profile of the wave equation that is carefully considered through the Neumann boundary conditions. Each motif presented in this batik not only presents visual beauty, but also depicts the complexity contained in the wave movement and enriches the understanding of the phenomenon in a deep mathematical context.

2. WAVES

2.1. Moving Wave

In Figure 1 and Figure 2 are the results of functions that are generally in the form of

$$u\,(x,t) = \psi\,(x + ct) + \phi\,(x - ct)$$

This wave equation moves with a two-way motion. So physically if $u\,(x,t) = sin\,(x - ct)$ the wave moves to the right and $u\,(x,t) = (x + ct)^{2}$ the wave moves to the left then $u\,(x,t) = sin\,(x - ct) + (x + ct)^{2}$ is a wave that moves in both directions (left and right).

2.2. The Philosophical Meaning of Moving Waves

The wave movement batik motif is inspired by two graphic images in Figure 1 and Figure 2. The moving wave motif in batik creates a dynamic and captivating visual, depicting life and the journey of energy in the form of waves moving across the surface of the fabric. The symmetry and flow created by this motif give the impression of continuous movement, as if the waves themselves are moving at a constant speed. In addition, this motif also contains a deep philosophical meaning, reflecting the journey of life that is constantly changing and moving towards a certain goal. Like waves in the ocean that never stop moving, we are also reminded

to continue to move forward in life, face challenges, and achieve our full potential with strength and determination.

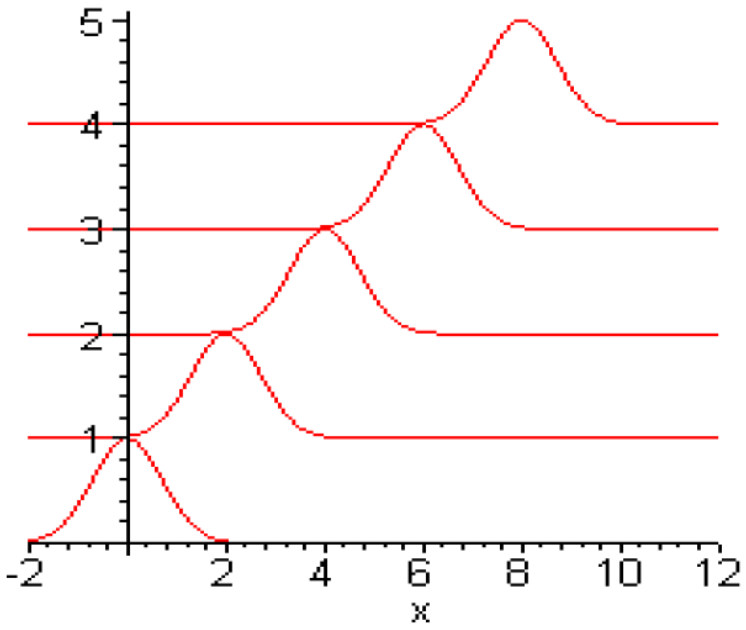

Figure 1. Waves Moving to the Right (Akhsan et al., 2016)

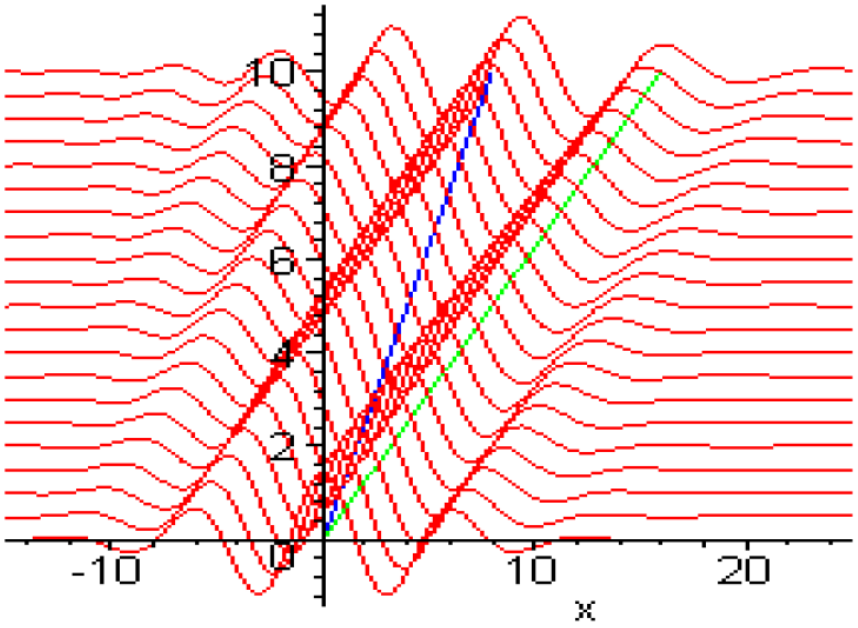

Figure 2. Waves Moving Left and Right (Akhsan et al., 2016)

2.3. Neumann Boundary Conditions

The Neumann boundary condition batik motif is inspired by Figure 3. The wave profile using the series approximation method on the interval [0,1] with Neumann boundary conditions and initial conditions $f\ (x)\ =\ x^3(1\ -\ x)^2$ and $g(x)\ =\ 0$ produces the graph in Figure 3.

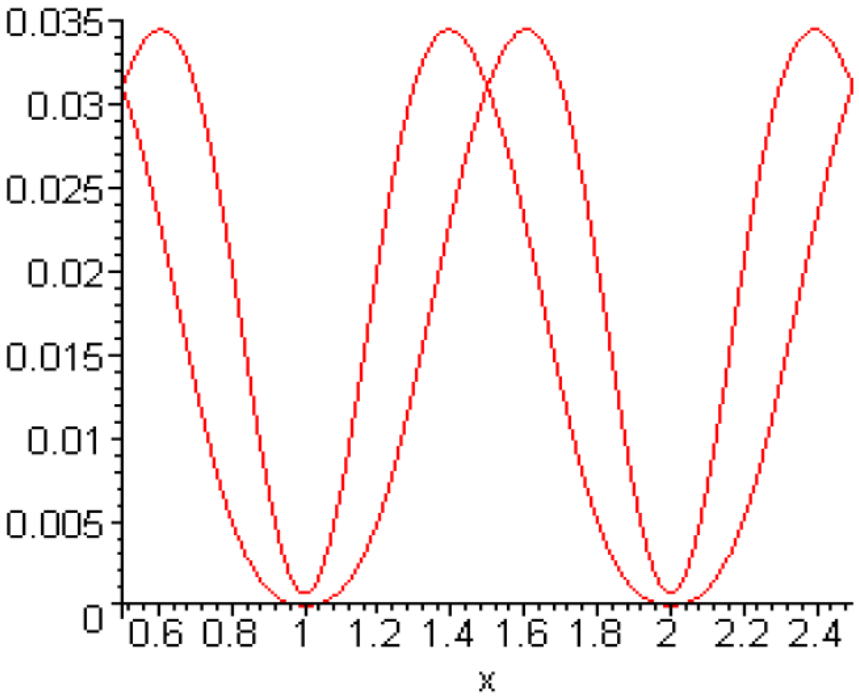

Figure 3. Neumann Boundary Conditions (Akhsan et al., 2016)

2.4. Philosophical Meaning of Neumann Boundary Conditions

The Neumann boundary condition batik motif in batik illustrates the strict yet elegant mathematical principles in regulating the interaction of waves with their environmental boundaries. Through geometric patterns and regular lines, this motif creates a visualization of how waves interact with the given environmental boundaries. The elegance of this motif reflects the mathematical rigor of the Neumann boundary condition, where the change in wave gradient remains constant at the boundary points. Thus, this motif not only presents visual beauty, but also illustrates the complexity and mathematical regularity of the Neumann boundary condition in the context of the wave equation.

This motif also has a deep philosophical meaning about the importance of having firmness, regularity, and balance in living life. It reminds us to maintain solid principles, face challenges steadfastly, and create harmony in our lives.

2.5. Wave Motion with Neumann Boundary Conditions

The wave motion with Neumann boundary conditions is given by Figure 4 with the equation $f(x) = \sin(x)$ and the value of $c = 1$.

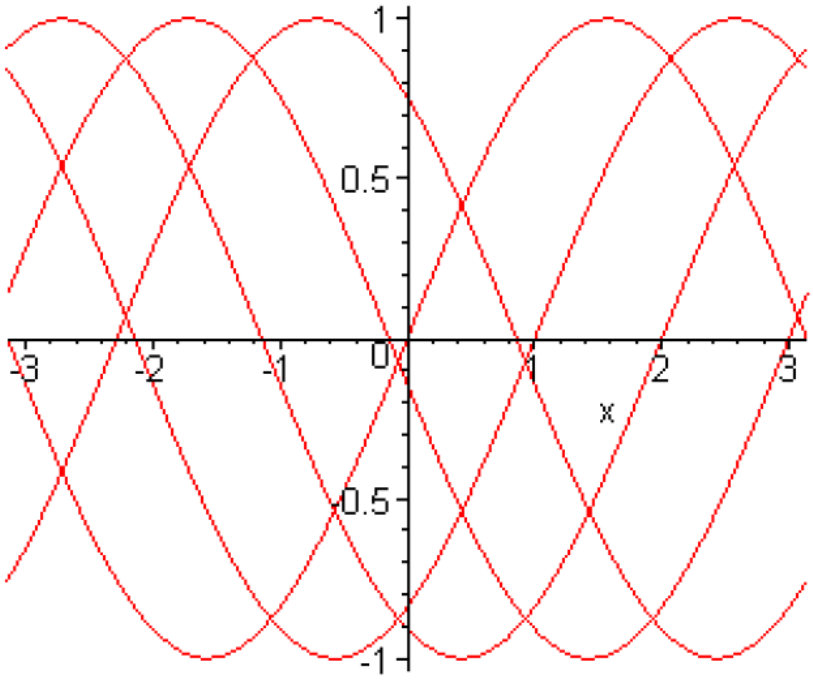

Figure 4. Wave Profile with Neumann Boundary Conditions (Akhsan et al., 2016)

2.6. The Philosophical Meaning of Wave Motion with Neumann Boundary Conditions

The wave motion batik motif with Neumann boundary conditions in batik displays a harmonious blend of the dynamics of wave motion and the strictness of mathematical boundary conditions. With elegant and orderly flowing patterns, this motif illustrates how waves move in balance determined by Neumann boundary conditions. This visualization creates the impression of controlled yet dynamic movement, along with the mathematical provisions that govern changes in wave gradients at boundary points. In this case, this motif not only exudes aesthetic beauty, but also illustrates the harmony between the elegance of wave motion and the mathematical strictness of Neumann boundary conditions.

This motif also has a deep philosophical meaning about the importance of balance between strength and flexibility. Although bound by strict mathematical rules, the waves in this motif are still able to flow with grace and flexibility, adapting to their environment without losing their essence or identity. This reminds us that in facing challenges and limitations in life, we need to maintain the steadfastness of principles but remain open to change and adaptation. The wave motion batik motif with Neumann boundary conditions was inspired by the graphic image in Figure 4.

3. BATIK PROCESS

The batik process is as follows.

a. The process of drawing motifs on Tracing Paper (Figure 5)

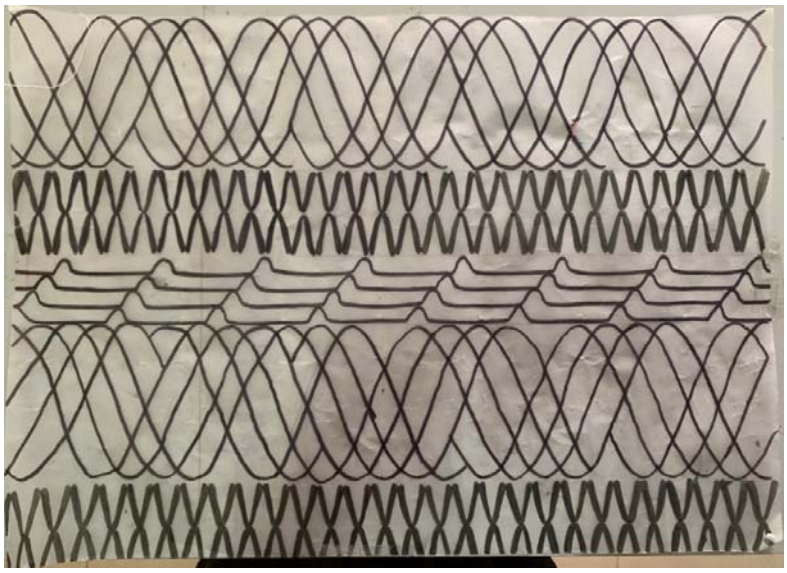

Figure 5. Batik Motif on Tracing Paper

b. The process of drawing motifs on Primisima cloth (Figure 6)

Figure 6. Depiction of Batik Motifs on Primisima Cloth

c. Batik process. Figure 7 and Figure 8 are the finished batik motifs.

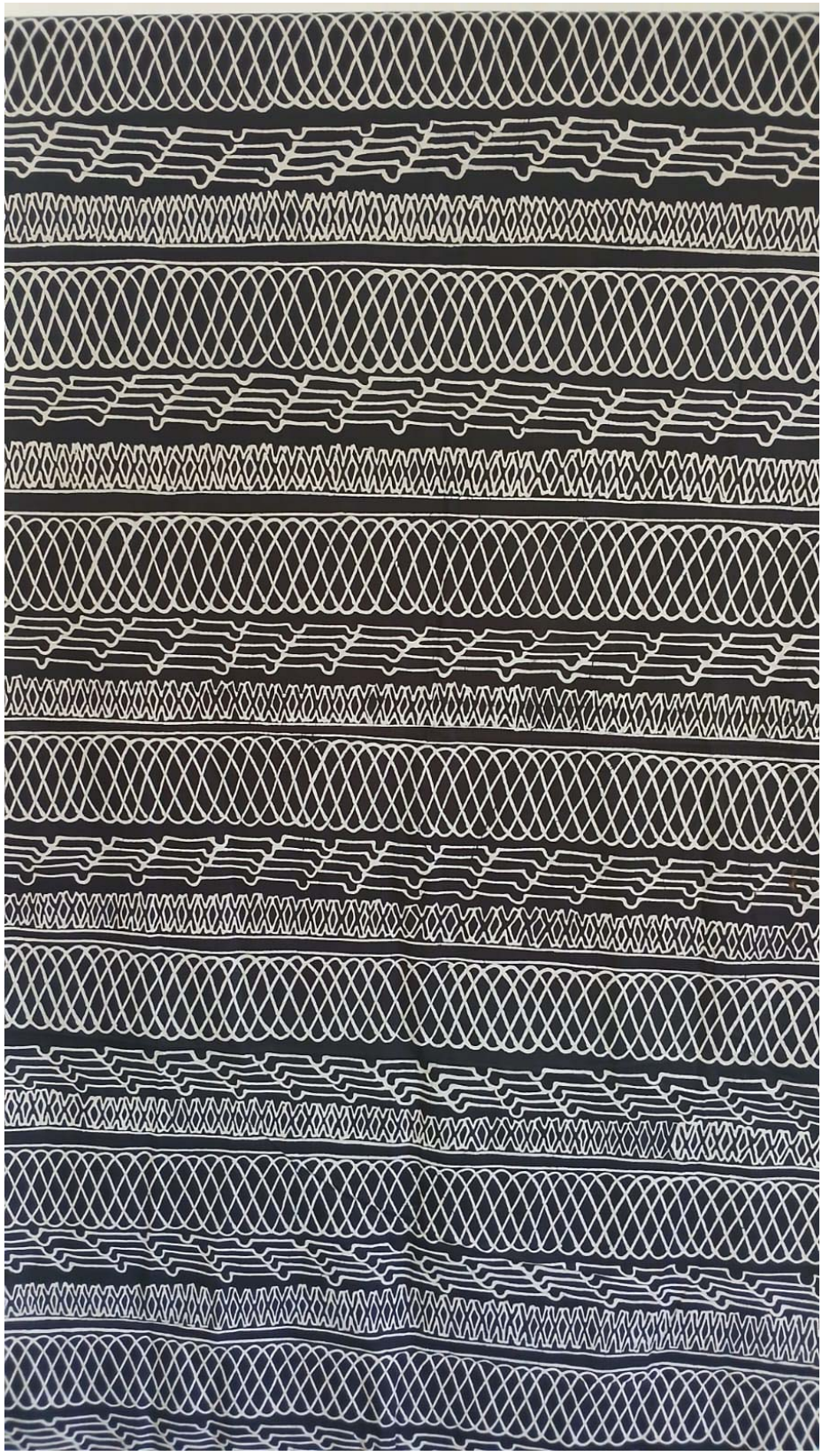

Figure 7. Waves in Batik Motifs

Figure 8. Waves in Batik Motif Combined with White

4. CONCLUSION

The batik motif of moving waves with Neumann boundary conditions uses three graphs from the results of the simulation. The philosophical meaning of the batik motif of moving

waves with Neumann boundary conditions is that one must step forward, face challenges, achieve one's potential, and maintain steadfastness.

5. REFERENCE

Akhsan, M., Hidayat, R., & Pradjaningsih, A. PROFIL PERSAMAAN GELOMBANG DENGAN VARIASI SYARAT BATAS.