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BATIK MOTIF FROM HEAT WAVE

Sugiyanto[1], Kharisma Muhammad Adzani[2], Ahlul Qulub[3], Ridwan Muhammad Saputra[4]

[1, 2, 3, 4, 5] Department of Mathematics, Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia

Correspondence: Sugiyanto, Email: sugiyanto@uin-suka.ac.id

Abstract

Heat wave batik is a batik motif inspired by the phenomenon of heat waves visualized in the form of a repeating pattern. This batik is inspired by the dynamic response equation of concrete plates using mathematical equations to understand the vibration characteristics and force distribution in the structure. The equation used describes the temperature and force changes that occur on the concrete slab due to the interaction between external loads and environmental factors. The simulation results in the form of graphs show how variables such as position and time affect the distribution of moment and shear force on the plate. This batik also examines the philosophy of batik motifs in the context of structural resilience, highlighting the interaction between design elements and engineering techniques. In addition, the meaning of batik motif philosophy reflects the challenge of designing a strong concrete structure.

Keywords: Heat Wave Batik, Dynamic Response, Concrete Plate, Philosophical Meaning, Durability.

1. INTRODUCTION

Heat wave batik is one type of batik motif inspired by the natural phenomenon, namely heat wave. This motif usually depicts a pattern that looks like undulating heat waves, creating an interesting optical effect.

2. DYNAMIC RESPONSE

2.1. Dynamic Response Equation of Concrete Plate

For the first equation, Equation (1) is used.

$$u(x,t) = \frac{8}{\pi}\sum_{m=1}^{\infty} \frac{\sin\left((2m-1)x\right)}{(2m-1)^3} e^{-(2m-1)^2\alpha^2 t} \quad (1)$$

for $0 \le t \le 2, \quad 0 \le x \le 3.14$.

Figure 1 means that the temperature at the position $x = 0$ and $x = \pi$ at time $t = 0$ is always zero degrees. This is because the temperature at both ends is maintained at zero degrees. However, the temperature at position $x = \pi^2$ at time $t = 0$ is the highest compared to other positions. This is because the position $x = \pi^2$ is the center of the heat source on the metal rod. The temperature at the position $x = \pi^2$ will decrease, along with the passage of time until the temperature reaches zero. For the second equation, Equation (2) is used.

$$u(x,t) = \frac{1}{2} - \frac{4}{\pi^2}\sum_{m=1}^{\infty} \left(\frac{1}{(2m-1)^2}\right) \cos\left((2m-1)\pi x\right) e^{-\alpha^2(2m-1)^2\pi^2 t} \quad (2)$$

for $0 \le t \le 1, \quad 0 \le x \le 1$. If Equation (2) is presented in the form of a plot using Octave Software, it looks like Figure 2.

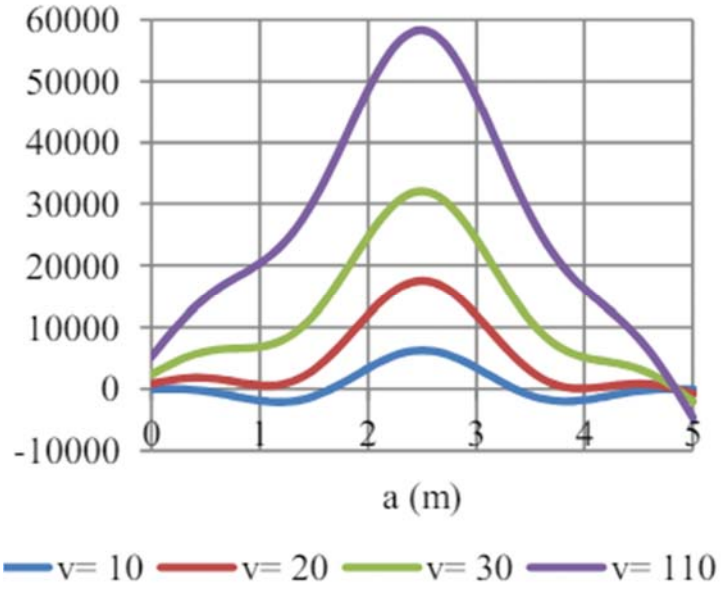

Figure 1. Graph of moment of plate x direction (Liucius & Alisjahbana, 2019)

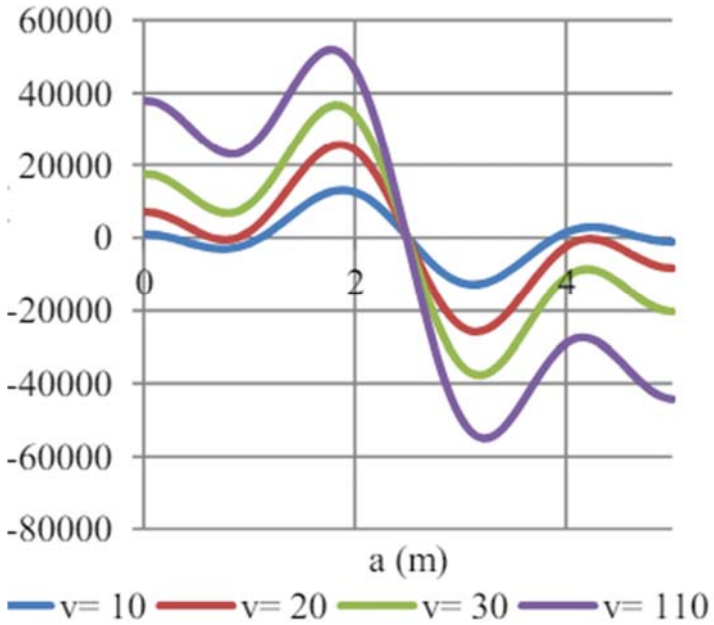

Figure 2. Graph of plate shear force in y direction (Liucius & Alisjahbana, 2019)

Figure 2 means that the temperature at the middle point of the metal rod for $t = 0$ is the hottest compared to other positions. This is because that position is the center of heat supply. However, after $t = 0$, the temperature at position $x = \frac{1}{2}$ decreases as time goes by. For $t = 0$, the temperature at position $x = 0$ and $x = 1$ is zero degrees. As a result of providing heat exactly at the middle point of the metal rod, so that the heat will spread to both ends of the metal rod. Therefore, the temperature at position $x = 0$ which is initially zero degrees will rise for

some time, after that it will decrease until the temperature is constant towards zero degrees. However, at position $x = 1$ at time $t = 0$ the temperature is zero degrees will remain zero degrees, this is due to the isolator at position $x = 1$.

2.2. The Philosophical Meaning of the Dynamic Response Equation of Concrete Plates

The philosophy of batik motifs inspired by the dynamic response equation of concrete slabs reflects the interaction between the forces of nature and human engineering in facing structural challenges. This motif combines design elements that describe movement, vibration, and dynamics similar to the response of concrete slabs to external loads such as earthquakes or other vibrations. Just like concrete slabs designed to absorb and distribute energy, this batik motif illustrates the value of resilience, balance, and adaptability in the face of change or pressure. Thus, this batik is not only a work of art, but also a symbol of philosophy that reflects the relationship between technological progress and traditional wisdom in creating harmony and resilience in life.

3. BATIK PROCESS

The batik process is as follows.

a. Graphic design results on tracing paper (Figure 3).
b. The process of making batik cloth.
c. Hot Wave Batik Motif (Figure 4).

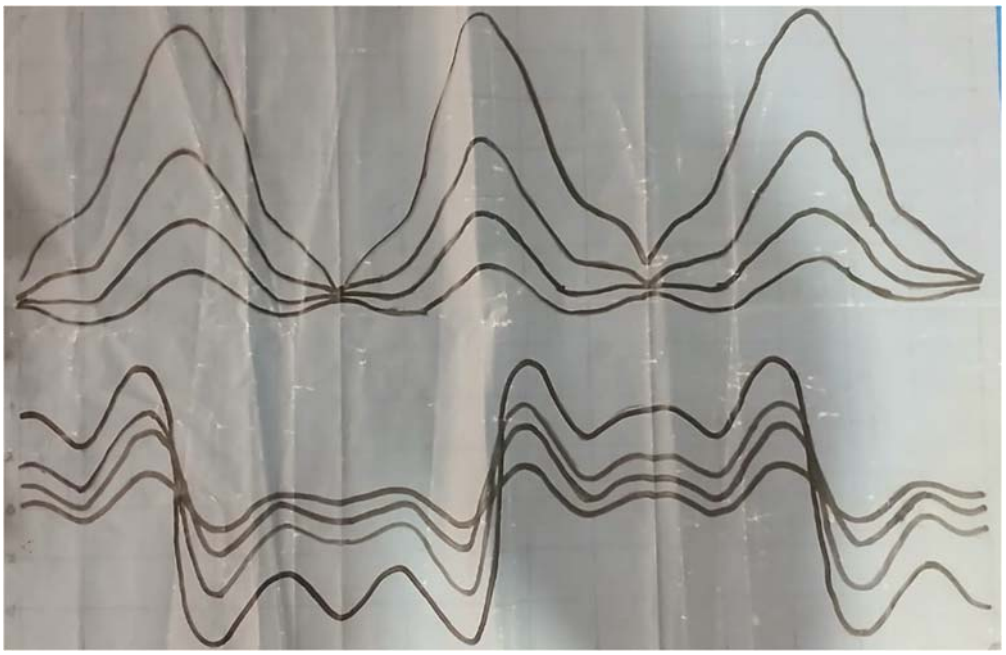

Figure 3. Graphic Design Results on Graph Paper

Figure 4. Heat Wave Batik Motif

4. CONCLUSION

Based on the results of the analysis, we can conclude that the position, time, and material properties affect the temperature and force changes on the concrete slab. The center of the plate initially has the highest temperature before decreasing. The distribution of moment and shear force reflects the distribution of energy in the system. This mathematical approach can also inspire the meaning of batik motif philosophy, which is an architectural design that is more adaptive to the environment.

5. REFERENCE

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