# USING THE EXPLICIT METHOD TO SOLVE PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS OF TEMPERATURE DISTRIBUTION IN THE CONDUCTOR OF A CRUDE CIRCUIT BREAKER

(Menggunakan Kaedah Tersurat untuk Menyelesaikan Persamaan Pembezaan Separa Parabola bagi Taburan Suhu dalam Konduktor Pemutus Litar Kasar)

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## ABSTRACT

In Malaysia, the circuit breaker is one of the most important and essential safety mechanisms in every building. When electricity enters a house, it goes to a circuit breaker box to be divided into a number of circuits. Each of these circuits is protected by a breaker or a fuse. For safety purposes, electrical appliances are designed to keep the current flow at a low level. However, whenever the current flow jumps above the safety level, the circuit breaker does its job by cutting off the circuit. This is done by the conductor's bending (a bimetallic strip or rod) in the circuit breaker when the wire temperature rises. If the conductor needs to bend upward when heated, the thermal conductivity of the lower metal rod must be higher than that of the upper rod. This paper focuses on the temperature distribution in the conductor of a crude circuit breaker in a fire alarm system by using different materials such as a bimetallic rod. The paper also describes how different materials can affect the efficiency of the fire alarm system. An implicit method makes it possible to tackle such problems. This can be achieved by the development of a simultaneous linear equations' system for temperature at a specified point in time for the entire interior nodes. Based on the simulation results, it was found that the explicit method (em) is a simple mechanism to solve parabolic partial differential equations (pde). The results can also be improved by using the implicit method to minimize errors.

*Keywords*: explicit method; parabolic partial differential equations; temperature distribution

## ABSTRAK

Di Malaysia, pemutus litar merupakan satu daripada mekanisme keselamatan yang paling penting dan diperlukan pada setiap bangunan. Apabila elektrik mengalir ke sebuah rumah, ia mengalir ke kotak pemutus litar yang dibahagikan kepada beberapa litar. Setiap litar ini dilindungi oleh pemutus atau fius. Bagi tujuan keselamatan, peralatan elektrik dibuat untuk memastikan aliran arus adalah pada tahap rendah. Kemudian, setiap kali arus mengalir melebihi tahap yang selamat, pemutus litar melakukan tugasnya dengan memutuskan litar elektrik. Hal ini dilakukan dengan menlenturkan konduktor (jalur atau batang dwibesi) pada pemutus litar apabila suhu wayar meningkat. Dalam kes ini, sekiranya konduktor perlu membengkok ke atas ketika dipanaskan, kekonduksian terma rod logam bawah mestilah lebih tinggi daripada batang di sebelah atas. Dalam artikel ini, fokusnya adalah kepada taburan suhu pada konduktor pemutus litar anggaran dalam sistem penggera kebakaran dengan menggunakan bahan yang berbeza sebagai batang dwifungsi. Kemudiannya turut dibincangkan bagaimana bahan yang berbeza dapat mempengaruhi kecekapan sistem penggera kebakaran. Suatu kaedah tersirat memungkinkan kita untuk menyelesaikan masalah-masalah ini dengan menjanakan sistem persamaan linear serentak untuk suhu di semua nod dalaman pada waktu tertentu. Daripada hasil simulasi, keputusan menunjukkan bahawa kaedah tersurat adalah suatu mekanisme mudah untuk menyelesaikan persamaan pembezaan separa parabola. Hasilnya juga dapat ditingkatkan dengan menggunakan kaedah tersirat untuk meminimumkan ralat.

*Kata kunci*: kaedah tersurat; persamaan pembezaan separa parabola; taburan suhu

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