Terminology Explanation

Name: Koichiro Koga
Student ID: 08C23031

Terminology (Technical word)

Linear

Explanation

In mathematics and engineering, a relationship is described as **linear** if it can be represented graphically as a straight line. This implies a proportional relationship ($y = ax + b$) between an input and an output, making the system's behavior simple and predictable. While most real-world phenomena are governed by complex non-linear dynamics, their behavior can often be effectively modeled as linear within a specific, limited operational range. This powerful technique, known as **linear approximation**, is a cornerstone of engineering analysis, allowing us to transform potentially unsolvable problems into manageable calculations. This principle was crucial during the final tuning of our basketball launcher for the NHK Student Robocon. To achieve consistent accuracy, we needed a reliable model linking roller speed to shooting distance. We conducted a series of controlled experiments, systematically varying the roller speed and measuring the resulting distance for each trial. When this empirical data was plotted on a graph, it revealed a surprisingly clear trend: the data points formed an almost perfect straight line, indicating the system behaved linearly within our range of interest. Capitalizing on this discovery, we fit an optimal approximate line to our data points, which yielded a simple linear equation that served as an accurate predictive model. With this tool, we could instantly calculate the precise motor speed needed for any target distance, bypassing the slow and often frustrating process of manual trial-and-error. This mathematical shortcut not only saved invaluable time during our final practice sessions but also gave us deep confidence in our machine's calibration and consistency. Our experience is a clear testament to the power of linear approximation in a practical setting. It shows how a fundamental mathematical concept can be applied to effectively model, predict, and control a complex physical system. This ability to simplify reality into a predictive model is foundational in engineering, enabling intelligent, data-driven solutions to replace inefficient guesswork with calculated precision.

Source

"Linear Differential Equations (線形微分方程式)." *Kogakuin University*. Accessed: Oct. 15, 2025. `https://brain.cc.kogakuin.ac.jp/~kanamaru/lecture/simdif/03-01.html`