НАУЧНАЯ АРТЕЛЬ
АКАДЕМИЧЕСКОЕ ИЗДАТЕЛЬСТВО

АЭТЕРНА
НАУЧНО-ИЗДАТЕЛЬСКИЙ ЦЕНТР

16+

ISSN (p) 2712-9497
ISSN (e) 2542-1034

№ 6/2026

НАУЧНЫЙ ЖУРНАЛ
«EO IPSO»

Москва
2026

СОДЕРЖАНИЕ

МАТЕМАТИКА

Conclusion

The relationship between vector algebra, directional force tracking, and spatial system optimization is cyclical, mechanical, and self-reinforcing. Vector operations provide the mathematical frontier for mapping complex physical trajectories, spatial coordinate systems establish the analytical bridge to execute those designs safely, and expanding industrial output generates the capital required to fund next-generation aerospace research. To maintain technical self-sufficiency and maximize engineering precision, modern nations must ensure that their technical universities maintain a rigorous focus on applied vector mechanics. By fostering a generation of engineers and computer scientists who can fluently manipulate multi-dimensional vector systems, societies can guarantee the steady advancement of their physical infrastructure.

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SYMMETRY AND SCALING IN APPLIED MATHEMATICAL MODELS: COBB–DOUGLAS AND MANNING EQUATIONS

Abstract

This paper demonstrates that the Cobb–Douglas function (economics) and the Manning equation (hydraulic engineering) share a unified mathematical architecture based on multiplicative power laws and homogeneous scaling. Both models exhibit invariance under dilation transformations, unified analytically by logarithmic linearization and Euler's theorem. Beyond the theoretical framework, this comparative analysis highlights the educational value of interdisciplinary modeling, helping students recognize universal structural patterns across different scientific domains.

Keywords:

Cobb–Douglas function; Manning equation; scaling symmetry; homogeneous functions; power-law models; interdisciplinary mathematics; mathematical modeling.

1 Introduction

Mathematical models across diverse disciplines often share identical structural forms. Despite appearing unrelated, the Cobb–Douglas production function in economics (modeling output from labor and capital) and the Manning equation in hydraulic engineering (estimating open-channel water discharge) both utilize a common mathematical architecture based on multiplicative power laws, scaling transformations, and homogeneous functions.

This paper analyzes the structural similarities between these two models through the lens of symmetry and scaling theory. We demonstrate that both equations function as homogeneous power-law systems