

Boosting Rocket Performance without Calculus

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Given

$$v = -c \cdot \log\left(1 - \frac{ea}{a + 1 + b(a + 1)}\right) - c \cdot \log\left(1 - \frac{e}{1 + b(a + 1)}\right)$$

where $a > 0, b > 0, c > 0, 0 < e < 1$, maximize v with appropriate a .

The above rocket performance optimization problem is solved using calculus [1]. However, there is an alternative that requires only high school mathematics with the help of a Computer Algebra System (CAS). This non-calculus approach places more emphasis on problem solving through mathematical thinking, as all symbolic calculations are carried out by the CAS [2]. It also makes a range of interesting problems readily tackled with minimum mathematical prerequisites.

Keywords

Optimization, Computer Algebra, High School Mathematics

References

- [1] D. BURGHES; M. BORRIE, *Modelling with Differential Equations*. Ellis Horwood Limited, Chichester, 1982.
- [2] *Omega: A Computer Algebra System Explorer*, at <http://www.omega-math.com>.