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Application of Mathcad Program in Solving Conditional Extremum Problem

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Abstract:

The issue of conditional extremum plays an important role in solving technical and technological issues. There are different ways to solve this type of problem. This article shows methods for solving the conditional extremum in the MathCAD software package. Solving problems in this way emphasizes that with the help of information technology, calculations can be facilitated.

Keywords: conditional extremum, Lagrange, function, volume, optimization, MathCAD, constraint.

Introduction

The development of information technology leads to an innovative approach to the teaching process. This motivates students to solve practical problems.

Use of mathematical programs - building a mathematical model of the studied process, creating a solution algorithm, obtaining a solution, and making the right decision based on the solution.

Conditional extremum problem is divided into several types depending on the process being studied.

We will consider the following issues:

Task 1. Find the largest parallelepiped among the right-angled parallelepipeds with a total surface area of 12 m3.

To solve this problem, we construct the Lagrange function.

$$f(x, y, z, \lambda) = xyz - \lambda(xy + yz + xz - 6)$$

We will solve the problem in the Mathcad program

$$f(x,y,z,\lambda) := x \cdot y \cdot z + \lambda \cdot (x \cdot y + x \cdot z + y \cdot z - 6)$$

hosila olamiz $\quad f1(x,y,z,\lambda) := \frac{d}{dx} f(x,y,z,\lambda) \rightarrow \lambda \cdot (y + z) + y \cdot z$

$$f2(x,y,z,\lambda) := \frac{d}{dy} f(x,y,z,\lambda) \rightarrow \lambda \cdot (x + z) + x \cdot z$$

$$f3(x,y,z,\lambda) := \frac{d}{dz} f(x,y,z,\lambda) \rightarrow \lambda \cdot (x + y) + x \cdot y$$

$$f4(x,y,z,\lambda) := \frac{d}{d\lambda} f(x,y,z,\lambda) \rightarrow x \cdot y + x \cdot z + y \cdot z - 6$$

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Demak $f1(x,y,z,\lambda) := 0$

$f2(x,u,z,\lambda) := 0$

$f3(x,y,z,\lambda) := 0$

$f4(x,y,z,\lambda) := 0$

Masala shartidan $x > 0$ $y > 0$ $z > 0$

$$z^2 \cdot (x - y) \text{ solve}, x \rightarrow y$$
$$x^2 (y - z) \text{ solve}, y \rightarrow z$$

u holda $3 \cdot x^2 - 6 \text{ solve} \rightarrow \begin{pmatrix} \sqrt{2} \\ -\sqrt{2} \end{pmatrix}$

$x := \sqrt{2}$ $v := x^3 = 2.828$

The problem of conditional extremum is brought to the problem of linear programming in economics.

An example. $f(x) = 3x + 2y \rightarrow \max$

Conditions of limitation

$$\begin{cases} x + 2y \le 7 \\ 2x + y \le 8 \\ x \le 3 \\ x \ge 0, y \ge 0 \end{cases}$$

Let's work on the example in the MathCad program

$f(x,y) := 3 \cdot x + 2 \cdot y$

Given

$x + 2 \cdot y \le 7$

$2 \cdot x + y \le 8$

$x \le 3$

$x \ge 0$ $y \ge 0$

$Z := \text{Maximize}(f, x, y)$

$Z = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $f(3,2) = 13$

Conclusion

The use of Mathcad software in solving practical problems in higher mathematics classes increases the quality and efficiency of education.

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