MATEMATIK ANALIZNING AYRIM DOLZARB MUAMMOLARI

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ANNOTATSIYA

Ushbu maqolada matematik analizning ayrim dolzarb masalalaridan biri murakkab funksiyani xususiy hosilalari yordamida topish masalasi ko‘rib chiqiladi. Maqoladan oliy ta’lim muassasalari talaba yoshlari hamda qiziquvchi yoshlar foydalanishlari mumkin.

Kalit so‘zlar: *Xususiy hosila, murakkab funksiya, differensil, chiziqli almashtirish, chiziqli bog‘liqlik.*

SOME IMPORTANT ISSUES OF MATHEMATICAL ANALYSIS

ABSTRACT

This article considers one of the mathematical problems of finding a complex function using its personal derivatives. Higher education students and interested youth can download the article.

Keywords: *Eigenderivative, complex function, differential, linear substitution, linear dependence.*

KIRISH

Matematik analiz fani oliy matematikaning asosiy tarkibiy qismi bo‘lib, ushbu fanni o‘rganish uchun talabaladan algebra va analiz asoslaridan dastlabki bilimlari kerak bo‘ladi. Matematik analiz asosan funksiyalarni va o‘zgaruvchi miqdorlar orasidagi munosabatlarni o‘rganadi. Uning asosini esa differensial va integral hisob tashkil etadi. U o‘ziga xos tadqiqot uslubiga ya’ni cheksiz kichik yoki limitga o‘tish vositasida analiz qilish, asosiy tushunchalarning ma’lum majmuasi (funksiya, limit, hosila, differensial, integral, qator) ga ega.

ADABIYOTLAR TAHLILI VA METODOLOGIYA

1-ta’rif. Ushbu

$$\lim_{\Delta x_k \to 0} \frac{\Delta x_k f(x^0)}{\Delta x_k}, (k = \overline{1, m})$$

limitga $f(x) = f(x_1, \dots, x_m)$ funksiyaning x^0 nuqtadagi x_k o‘zgaruvchi bo‘yicha xususiy hosilasi deyiladi va u $\frac{\partial f(x^0)}{\partial x_k}$ kabi belgilanadi.

Xususiy hosilaning geometrik ma’nosini bilish uchun $M \subset R^2$ to‘plamda aniqlangan $z = f(x, y)$ funksiyani qaraymiz. Aytaylik $x_0, y_0 \in M$ bo‘lib, bu nuqtada $\frac{\partial f(x_0,y_0)}{\partial x}$ va $\frac{\partial f(x_0,y_0)}{\partial y}$ lar shunday bo‘lsin. $z = f(x, y)$ funksiya grafigi R^3 da biror sirtni aniqlaydi. $\Rightarrow z = f(x, y_0)$ ning grafigi sirt bilan $y = y_0$ tekislikning kesishishida hosil bo‘lgan Γ_1 chiziq bo‘ladi. $z = f(x_0, y)$ning grafigi Γ_2 chiziq bo‘ladi. Agar Γ_1 va Γ_2 chiziqlarning $(x_0, y_0, f(x_0, y_0))$ nuqtasiga o‘tkazilgan urinmaning Oxy tekisligi bilan hosil qilgan burchaklarini mos ravishda α va β deb belgilasak, unda

$$\frac{\partial f(x_0,y_0)}{\partial x} = tg\alpha \text{ va } \frac{\partial f(x_0,y_0)}{\partial y} = tg\beta$$

bo‘ladi. Bundan $z = f(x, y)$ sirtning (x_0, y_0, z_0) nuqtasiga o‘tkazilgan urinma tekislik tenglamasi ushbu

$$z - z_0 = \frac{\partial f(x_0, y_0)}{\partial x} \cdot (x - x_0) + \frac{\partial f(x_0, y_0)}{\partial y} \cdot (y - y_0)$$

ko‘rinishda bo‘lishini hosil qilamiz.[1]

NATIJALAR

Masala. $\frac{\partial u}{\partial x}$ *va* $\frac{\partial u}{\partial y}$ xususiy hosilalarni hisoblash va f va g fuksiyalarning hosilalarini (f va g -differensiallanuvchi funksiyalar) yo`qotish yo`li bilan shunday tenglama tuzingki, $u(x, y) = f(x - y, y - z)$ funksiya uni qanoatlantirsin.

Yechish. Berilgan funksiyaning to‘la differensialini hisoblab olamiz

$$u = f(x - y, y - z) \quad u(x, y) - ?$$

$$du = df(x - y, y - z)$$

$$du = f'_{x-y} d(x - y) + f'_{y-z} d(y - z)$$

$$du = f'_{x-y}(dx - dy) + f'_{y-z}(dy - dz)$$

$$du = f'_{x-y}(dx - dy) + f'_{y-z}(dy - dz)$$

$$du = f'_{x-y} dx + \left(f'_{y-z} - f'_{x-y}\right) dy + \left(-f'_{y-z}\right) dz$$

xususiy hosilalar uchun

$$u'_x = f'_{x-y} \quad , \quad u'_y = f'_{y-z} - f'_{x-y}$$

$$u'_z = -f'_{y-z}.$$

$$u'_y = -u'_z - u'_x$$

$$u'_x + u'_y + u'_z = 0$$

tenglik o‘rinli ekanligidan,

$$u(x, y, z) = x - y + y - z$$

$$u(x,y,z) = x - z$$

Tekshiramiz:

$$u'_x = \frac{\partial(x-z)}{\partial x} = 1$$

$$u'_y = \frac{\partial(x-z)}{\partial y} = 0$$

$$u'_z = \frac{\partial(x-z)}{\partial y} = -1$$

Demak,

$$u(x,y,z) = x - z$$

Ikkinchi tomondan,

$$u(x,y,z) = (x-y)\cdot(y-z) = xy - xz - y^2 + yz$$

Chiziqli funksiyalarning nisbati ko‘rinishida ifodalasak,

$$u(x,y,z) = \frac{x-y}{y-z}$$

ga ega bo‘lamiz.

Masala. $u = f(\frac{x}{y};\frac{y}{z})$ $u(x,y,z)-?$

Yechish.

$$du = df(\frac{x}{y};\frac{y}{z})$$

$$du = f'_{\frac{x}{y}} d\left(\frac{x}{y}\right) + f'_{\frac{y}{z}} d(\frac{y}{z})$$

$$du = \left(\frac{1}{y}\cdot f'_{\frac{x}{y}}\right)dx + \left(\frac{1}{z}\cdot f'_{\frac{y}{z}} - \frac{x}{y^2}\cdot f'_{\frac{x}{y}}\right)dy - (\frac{y}{z^2}\cdot f'_{\frac{y}{z}})dz$$

$$u'_x = \frac{1}{y}\cdot f'_{\frac{x}{y}}$$

$$u'_y = \frac{1}{z}\cdot f'_{\frac{x}{y}} - \frac{x}{y^2}\cdot f'_{\frac{x}{y}}$$

$$u'_z = -\frac{y}{z^2}\cdot f'_{\frac{y}{z}}$$

Bundan,

$$f'_{\frac{x}{y}} = y\cdot u'_x$$

$$f'_{\frac{y}{z}} = -\frac{z^2}{y}\cdot u'_z$$

$$u'_y = \frac{1}{z}\cdot\left(-\frac{z^2}{y}\cdot u'_z\right) - \frac{x}{y^2}\cdot(y\cdot u'_x)$$

$$u'_y = -\frac{z}{y}\cdot u'_z - \frac{x}{y}\cdot u'_x$$

$$x\cdot u'_x + y\cdot u'_y + z\cdot u'_z = 0$$

Demak, $u(x,y,z) = \frac{x}{y} + \frac{y}{z}$

Tekshirish.

$$x\cdot\frac{\partial\left(\frac{x}{y}+\frac{y}{z}\right)}{\partial x} + y\cdot\frac{\partial\left(\frac{x}{y}+\frac{y}{z}\right)}{\partial y} + z\cdot\frac{\partial\left(\frac{x}{y}+\frac{y}{z}\right)}{\partial z} = 0$$

$$x\cdot\left(\frac{1}{y}\right) + y\cdot\left(\frac{-x}{y^2}+\frac{1}{z}\right) + z\cdot\left(\frac{-y}{z^2}\right) = \frac{x}{y} - \frac{x}{y} + \frac{y}{z} - \frac{y}{z} = 0$$

XULOSA

Agar $f(x)$ funksiya x^0 nuqtada differensiallanuvchi bo‘lsa, u holda bu funksiya shu nuqtada uzluksiz bo‘ladi. Murakkab funksiyalarni xususiy hosila yordamida sodda ko‘rinishga keltirishda ushbu xossadan foydalanamiz. Dastlab murakkab funksiyaning differensialini topib, soddalashtirishlardan so‘ng har bir argument bo‘yicha xususiy hosilalarni hisoblab, natijani integrallaymiz. Yuqoridagi natijalardan texnika, fizika va matematikaning boshqa ko‘plab sohalarida foydalanish mumkin.

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