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KO'P O'ZGARUVCHILI FUNKSIYALARNI DIFFERENSIALLASH

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Annotasiya: Tezisda kop o'zgaruvchili funksiyalarni differensiallash usullari haqida ma'lumotlar keltirilgan va unga oid misollar yordamida tushintirib o'tilgan. Ko'p o'zgaruvchili funksiyalarini differensialashdirish, funksiyadagi o'zgarishni o'zgaruvchilar bo'yicha baholash imkoniyatini beradi. Ko'p o'zgaruvchili funksiyaning differensiali esa, barcha o'zgaruvchilar bo'yicha o'zgarish tezligini topishga yorrdam beradi

Annotation: The thesis provides information on methods for differentiating kop variable functions and is explained using examples related to it

Аннотация: Диссертация содержит информацию о методах дифференцирования многомерных функций и объясняется на примерах, связанных с этим.

Kalit so'zlar: Ko'p o'zgaruvchili funksiya, differensial, nuqta orttirmasi, funksiya orttirmasi.

Faraz qilaylik, $f(\mathrm{x}) = (x_1, x_2, \ldots, x_m)$ funksiya $\mathrm{E} \subset R^m$ da berilgan bo'lib, $x^0=(x_1^0, x_2^0, \ldots, x_m^0) \in \mathrm{E}$

nuqtada differensiallanuvchi bo'lsin. U holda ta'rifga ko'ra funksiyaning x^0 nuqtadagi to'liq orttirmasi

$$\Delta f(x^0) = \frac{\partial f(x^0)}{\partial x_1}\Delta x_1 + \frac{\partial f(x^0)}{\partial x_2}\Delta x_2 + \ldots + \frac{\partial f(x^0)}{\partial x_m}\Delta x_m + \mathrm{o}\,(\mathrm{p}) \qquad (1)$$

bo'ladi. Bu munosabatda

$$\mathrm{P} = \sqrt{x_1^2, x_1^2, \ldots, x_m^2}$$

bo'lib, $\Delta x_1 \to 0$, $\Delta x_2 \to 0$, … , $\Delta x_m \to 0$, da $\mathrm{p} \to 0$.

1-ta'rif. f(x) funksiyaning $\Delta\mathrm{f}(x^0)$orttirmasidagi

$$\frac{\partial f(x^0)}{\partial x_1}\Delta x_1 + \frac{\partial f(x^0)}{\partial x_2}\Delta x_2 + \ldots + \frac{\partial f(x^0)}{\partial x_m}\Delta x_m$$

ifoda $f(\mathrm{x})$ funksiyaning x^0 nuqtadagi differensiali (to'liq differensiali) deyiladi va

$$\mathrm{d}f\,(x^0) \text{ yoki } \mathrm{d}f\,(x_1^0, x_2^0, \ldots, x_m^0)$$

kabi belgilanadi:

1-misol:

Funksiya differensialini hisoblaymiz:

$$f\,(\mathrm{x}, \mathrm{y}) = \left(\frac{x}{y}\right)^2 = e^{x\ln(\frac{x}{y})}$$

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Funksiya differensialini quyidagi formula yordamida hisoblaymiz.

$d\,f\,(x, y) = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$

Murakkab funksiyaning har bir o'zgaruvchisi bo'yicha xususiy hosilalarini olamiz

$\frac{\partial f}{\partial x} = (e^{x}ln(\frac{x}{y})(ln(\frac{x}{y}) + \frac{xy}{x}))dx = (e^{x}ln(\frac{x}{y})(ln(\frac{x}{y}) + y))dx$

$\frac{\partial f}{\partial y} = (e^{xln(\frac{x}{y})}(\frac{xy}{x}))dy = (e^{xln(\frac{x}{y})}\ y)dy$

Xususiy hosilalarni mos ravishda formulaga qo'yamiz

Natija: $d\,f\,(x, y) = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy = (e^{x}ln(\frac{x}{y})(ln(\frac{x}{y}) + y))dx + (e^{xln(\frac{x}{y})}\ y)dy$

2-misol:

Funksiya differensialini hisoblaymiz:

$f\,(x, y) = \arctan(\frac{x}{y}) + \arctan(\frac{y}{x})$

Funksiya differensialini quyidagi formula yordamida hisoblaymiz.

$d\,f\,(x, y) = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$

Murakkab funksiyaning har bir o'zgaruvchisi bo'yicha xususiy hosilalarini olamiz.

$\frac{\partial f}{\partial x} = (\frac{\frac{y}{x^2}}{\sqrt{1+\frac{y^2}{x^2}}} + \frac{\frac{1}{y}}{\sqrt{1+\frac{x^2}{y^2}}})dx$

$\frac{\partial f}{\partial y} = (\frac{\frac{1}{x}}{\sqrt{1+\frac{y^2}{x^2}}} - \frac{\frac{x}{y^2}}{\sqrt{1+\frac{x^2}{y^2}}})dy$

Xususiy hosilalarni mos ravishda formulaga qo'yamiz

Natija: $d\,f\,(x, y) = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy = (\frac{\frac{y}{x^2}}{\sqrt{1+\frac{y^2}{x^2}}} + \frac{\frac{1}{y}}{\sqrt{1+\frac{x^2}{y^2}}})dx + (\frac{\frac{1}{x}}{\sqrt{1+\frac{y^2}{x^2}}} - \frac{\frac{x}{y^2}}{\sqrt{1+\frac{x^2}{y^2}}})dy$

3-misol:

Funksiya differensialini hisoblaymiz: Bizga quyidagi murakkab funksiyalar berilgan bo'lsin.

$P = f\,(u, v, w),\ u = x^2 + y^2 + z^2,\ v = x + y + z,\ w = xyz;$

Funksiya differensialini quyidagi formula yordamida hisoblaymiz.

$d\,f = (\frac{\partial f}{\partial u}\frac{\partial u}{\partial x} + \frac{\partial f}{\partial v}\frac{\partial v}{\partial x} + \frac{\partial f}{\partial w}\frac{\partial w}{\partial x})dx + (\frac{\partial f}{\partial u}\frac{\partial u}{\partial y} + \frac{\partial f}{\partial v}\frac{\partial v}{\partial y} + \frac{\partial f}{\partial w}\frac{\partial w}{\partial y})dy + (\frac{\partial f}{\partial u}\frac{\partial u}{\partial z} + \frac{\partial f}{\partial v}\frac{\partial v}{\partial z} + \frac{\partial f}{\partial w}\frac{\partial w}{\partial z})dz$

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Murakkab funksiyaning har bir o'zgaruvchisi bo'yicha xususiy hosilalarini olamiz.

$\frac{\partial u}{\partial x} = 2x,\ \frac{\partial v}{\partial x} = 2y,\ \frac{\partial w}{\partial x} = 2z;$

$\frac{\partial u}{\partial y} = 1,\ \frac{\partial v}{\partial y} = 1,\ \frac{\partial w}{\partial y} = 1;$

$\frac{\partial u}{\partial z} = yz,\ \frac{\partial v}{\partial z} = xz,\ \frac{\partial w}{\partial z} = xy;$

Xususiy hosilalarni mos ravishda formulaga qo'yamiz

Natija: $df = (\frac{\partial f}{\partial u} 2x + \frac{\partial f}{\partial v} 1 + \frac{\partial f}{\partial w} yz)dx + (\frac{\partial f}{\partial u} 2y + \frac{\partial f}{\partial v} 1 + \frac{\partial f}{\partial w} xz)dy + (\frac{\partial f}{\partial u} 2z + \frac{\partial f}{\partial v} 1 + \frac{\partial f}{\partial w} xy)dz$

Xulosa: Xulosa qilib shuni aytish mumkinki, Talabalar murakkab funksiyalarni differensiyallash jarayonini soddalashtirish va bu usul bo'yicha ko'plab misol va masalalar yechimini topish bo'yicha bilim va ko'nikmalar hosil qilishadi.

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