ODDIY DIFFERENSIAL TENGLAMALAR UCHUN HOLATLAR TEKISLIGINI ANIQLASH

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ANNOTATSIYA

Biz bu maqolada oddiy differensial tenglamalar uchun ba'zi bir holatlar tekisligini ko'rib chiqamiz,shu bilan birgalikda ularning tekislikdagi sodda maxsus nuqtalari turlarini va shunga qarab qanday egri chiziqlar oilasiga kirishini ko'rib o'tamiz. Birinchi navbatda uning xarakteristik tenglamasini aniqlab olishimiz muhim rol o'ynaydi. Xarakteristik tenglamaga bog'liq ravishda ularning aynigan yoki aynimagan, turg'unlik holatini ko'tish imkoniyatiga ega bo'lamiz. Diffferensial tenglamalarning sifat nazariyasiga indeks haqidagi tushunchani muvozanat holatlarning joylanishiga bog'liq masalalarda A.Puankero kitritgan.Biz quyida endi bulardan foydalanib ba'zi funksiyalar uchun tatbiqlarini topib chiqamiz.

Ushbu maqolada $\frac{dy}{dx}=\frac{ax+by}{cx+dy}$ ko`rinishidagi differensial tenglamaning O(0,0) nuqta atrofida yechimlarning manzarasi o'rganilgan. Unda nuqta atrofida yechimlarning tugun,egarsimon,fokus kabi ko`rinishlari kuzatilgan.

ANNATATION

In this article, we will consider some planes of states for ordinary differential equations, together with the types of their simple special points in the plane and what

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families of curves they belong to. First of all, it is important to determine its characteristic equation. Depending on the characteristic equation, we will have the opportunity to transfer them to a stagnant state. A. Poincareu introduced the concept of index to the qualitative theory of differential equations in the problems related to the location of equilibrium states.

In this article, the landscape of solutions $\frac{dy}{dx}=\frac{ax+by}{cx+dy}$ around the point O(0,0) of the differential equation is studied. In it, the appearance of the solution in the point trophy, such as a knot, a saddle, and a focus, was observed.

Kalit so`zlar: maxsus nuqta,differensial tenglama,maxsus yechim,yakkalangan nuqta,aynigan tugun,aynimagan tugun,holatlar tekisligi.

Inglizcha: special point, differential equation, special solution, isolated point, fixed node, fixed node, plane of states.

Birinchi tartibli differensial tenglamaning holatlar tekisligini aniqlash

Bizga

$$\frac{ax+by}{cx+dy}=\frac{dy}{dx}$$

Tenglama integral egri chiziqlarining maxsus nuqta atrofidagi manzarasini o`rganish masalasi qo'yilgan bo'lsin.Biz buni almashtirishlar, ularning holatlari haqida biz X.P.Latipov,F.U.Nosirov,SH.I.Tojiyev **DIFFERENSIAL TENGLAMALARNING SIFAT NAZARIYASI VA UNING TATBIQLARI**(TOSHKENT" O`ZBEKISTON" -2002)kitobidan bilib olishimiz mumkin.

Endi biz misolga tatbiq qilamiz:

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1-Misol: $\frac{dy}{dx}=\frac{2x+4y}{x+y}$ O(0,0) nuqtada holatlar tekisligini aniqlang va yechim ko`rinishini aniqlang.

Yechish: $\frac{ax+by}{cx+dy}=\frac{dy}{dx}$ (1) ko'rinishidagi tenglama uchun $\varepsilon=\alpha x+\beta y$,$\mu=\gamma x+\delta y$ (2) almashtirish qilamiz,bunda α,β,γ,μ –biror haqiqiy o`zgarmas sonlar ,$\alpha\delta-\beta\gamma\neq 0$.

Bu almashtirishda (1) tenglamaning x=0,y=0 maxsus nuqta atrofida tekshirish $\varepsilon=0,\mu=0$ maxsus nuqta atrofida tekshirishga o`tadi.(2) almashtirish natijasida quyidagi tenglamaga ega bo`lamiz:$\frac{d\mu}{d\varepsilon}=\frac{\mu\vartheta_1}{\varepsilon\vartheta_2}$ ko`rinishga keladi.

a=2,c=d=1 b=4.$\varepsilon=\alpha x+\beta y,\mu=\gamma x+\delta y$ $\frac{d\mu}{d\varepsilon}=\frac{\gamma(x+y)+\delta(2x+4y)}{\alpha(x+y)+\mu(2x+4y)}$

$\begin{cases}\gamma(x+y)+\delta(2x+4y)=\vartheta_1(\gamma x+\delta y)\\ \alpha(x+y)+\beta(2x+4y)=\vartheta_2(\alpha x+\beta y)\end{cases}$ ni qo`llab,

$\begin{cases}(1-\vartheta_1)\gamma+2\delta=0\\ d\gamma+(4-\vartheta_2)\delta=0\end{cases}$ dan $\begin{cases}(1-\vartheta_2)\alpha+\alpha\beta=0\\ d\alpha+(4-\vartheta_2)\beta=0\end{cases}$ $\begin{pmatrix}1-\vartheta & 1\\ 2 & 4-\vartheta\end{pmatrix}=0$ $\vartheta_1=\frac{5+\sqrt{17}}{2},\vartheta_2=\frac{5-\sqrt{17}}{2}$,$\mu=C\varepsilon^{\frac{5+\sqrt{17}}{5-\sqrt{17}}}$ ko`rinishida topamiz,

$\frac{d\mu}{d\varepsilon}=\pm c\frac{5+\sqrt{17}}{5-\sqrt{17}}\varepsilon^{\frac{5+\sqrt{17}}{5+\sqrt{17}}-1}=\pm c(\frac{5+\sqrt{17}}{8})^2\varepsilon^{\frac{2\sqrt{17}}{5-\sqrt{17}}}$ bo`ladi.O(0,0) aynimagan shakl almashtirish orqali ko`riladi.

Tenglama ishlanganida C> $0\ bo`ldi.\ \varepsilon=0\ esa\ maxsus\ nuqta\ bo`ladi\ va\ shu\ nuqta\ orqali\ o`tadi.\ \vartheta_1\neq\vartheta_2$ holda har ikkala ildiz haqiqiy va har xil bo`ladi,$\frac{\vartheta_1}{\vartheta_2}>1\ bo`lsin, u\ holda$

$$\frac{d\mu}{d\varepsilon}=\pm C\frac{\vartheta_1}{\vartheta_2}\varepsilon^{\frac{\vartheta_1}{\vartheta_2}-1}\ va\ \lim_{\varepsilon\to 0}\frac{d\mu}{d\varepsilon}=0\ bo`ladi.$$

Bu tenglamaning grafigini quyidagicha tasvirlsh mumkin:

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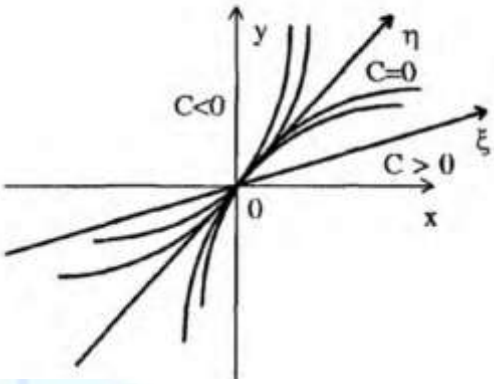


2-Misol. $\frac{dy}{dx} = \frac{-x+\alpha y}{\alpha x+y}$ tenglamaning holatini aniqlang.

Yechish: $\frac{dy}{dx} = \frac{-x+\alpha y}{\alpha x+y}$ a=-1,b=$\alpha, c = \alpha, d = 1$ $\begin{vmatrix} \alpha-\lambda & 1 \\ -1 & \alpha-\lambda \end{vmatrix} = 0$ $(\alpha-\lambda)^2 = -1$,

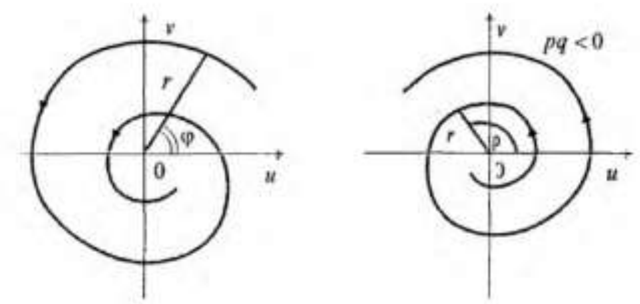
$\alpha - \lambda = \pm i \,, \lambda = \pm i - \alpha$

$\frac{d\mu}{d\tau} = \frac{\lambda_1}{\lambda_2} \times \frac{\mu}{\tau} = \frac{i-\alpha}{-i-\alpha}\frac{\mu}{\tau}$ shu ko`rinishga keldi.Ikkita qadamlar bilan,shakl almashtirishlardan so`ng qutb koordinatalar sistemasiga o`tamiz:

Kompleks ko`rinishga kelgani uchun:qdr+prdf=0 ko`rinishga kelib qoladi.

r=C$e^{-\alpha\varphi}$ ko`rinishga keladi.Bu O(0,0) maxsus nuqtani cheksiz ko`p aylanib o`tuvchi logarifmik spiralning tenglamasiga keldi.

Chizma:



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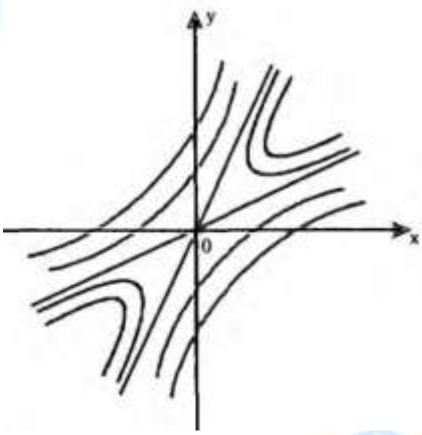
3-Misol. $\frac{dy}{dx} = \frac{x-2y}{3x-4y}$ $a = 1, b = -2, c = 3, d = -4$

Yechish: $\begin{vmatrix} 3-\lambda & -4 \\ 1 & -2-\lambda \end{vmatrix}$ $=0, \lambda_1 = 2, \lambda_2 = -1$, ildizlar haqiqiy va turli ishorali.

$$\lambda_1 \times \lambda_2 < 0, \frac{\lambda_1}{\lambda_2} = -2, \quad k = 2, k > 0$$

$\eta = C|\xi^{-2}|$ *shu ko\`rinishga keladi. Bu chizma egar ko\`rinishga keladi.*

Chizma:



FOYDALANILGAN ADABIYOTLAR:

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