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Farg‘ona davlat universiteti “Matematik analiz va differensial tenglamalar” kafedrasi, dotsent, fizika-matematika fanlari nomzodi **Abdurasul Rafikov** taqrizi ostida

QUTB KOORDINATALARI TIZIMIDA EGRICHIZIQNI ANIQLASHDA VA QURISHDA MAPLE DASTURLARIDAN FOYDALANISH

Аннотация

Analitik geometriyaning ikkinchi tartibli egri chiziqlari muxandislik masalalaridagi ajoyib jarayonlarni ifodalovchi harakat yo’llarini aniqlash va taxlil qilishga yordam beruvchi chziqlar hisoblanadi. Qutb koordinatalar sistemasida bu chiziqlarning barcha holatlarini aniqlashda va qurishda MAPLE dasturlaridan foydalanish imkoniyatlari ko’rsatilgan.

Kalit so‘zlarlar

qutb, koordinata, egri chiziq, animatsiya, plot, polar, symbol, display.

ИСПОЛЬЗОВАНИЕ ПРОГРАММ MAPLE ДЛЯ ОПРЕДЕЛЕНИЯ И ПОСТРОЕНИЯ КРИВЫХ В ПОЛЯРНОЙ СИСТЕМЕ КООРДИНАТ

Аннотация

Кривые второго порядка аналитической геометрии — это линии, которые помогают определять и анализировать траектории движения, представляющие собой важные процессы в инженерных задачах. Показаны возможности использования программ MAPLE для определения и построения всех случаев этих линий в полярной системе координат.

Ключевые слова

полюс, координата, кривая, анимация, график, полярный, символ, отображение

USING MAPLE PROGRAMS TO DEFINE AND CONSTRUCT POLAR CURVES

Abstract

Second-order curves of analytical geometry are lines that help define and analyze trajectories of motion, which are important processes in engineering problems. The potential of using MAPLE programs to define and plot all instances of these lines in a polar coordinate system is demonstrated.

Keywords

pole, coordinate, curve, animation, graph, polar, symbol, display

KIRISH. Hozirgi kunda axborot texnologiyalari inson faoliyatining barcha sohalariga, jumladan, qurilish sanoatiga integratsiya qilinmoqda. Har qanday muhandislik muammosini hisob-kitoblarsiz hal qilishning iloji yo'q. Ilgari amaliy hisob-kitoblarda matematikadan foydalanadigan mutaxassislar bir vaqtning o'zida dasturchi bo'lishlari va ancha murakkab hisoblash usullarini o'rganishlari kerak edi. Bu talab integratsiyalashgan matematik dasturiy ta'minot tizimlarining paydo bo'lishi bilan yo'qoldi. Maple kabi ixtisoslashtirilgan matematik dasturiy ta'minot paketlari kompyuterlarda muhandislik hisob-kitoblari uchun tobora ko'proq qo'llanilmoqda. Eng so'nggi versiyada raqamli va ramziy shakllarda matematik hisob-kitoblarni amalga oshirish imkonini beruvchi sun'iy intellekt tizimi mavjud. Maple interfeysi sodda va intuitiv, ulardan foydalanish oson va Windows standartlariga to'liq mos keladi. Grafiklar va matematik obyektlarni harakatlanuvchi palitralardan sichqonchani bosish orqali kiritish mumkin. Maple grafik muhiti sizga tanish formatda matematik formulalarni yozish imkonini beradi. Dastur yaratish va nosozliklarni tuzatish bir vaqtning o'zida amalga oshiriladi. Hujjatga yangi ifoda kiritish orqali foydalanuvchi nafaqat uning ekvivalentini hisoblashi, balki grafik yoki sirtni ham chizishi mumkin.

ASOSIY QISM. 1. Qutb koordinatalar sistemasidagi egri chiziqni nuqtalari bo‘yicha qurish.

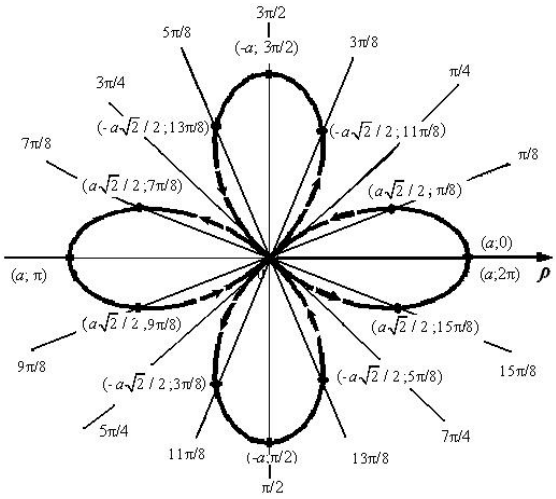
Berilgan $r = a\cos 2\varphi$ egri chiziq tenglamasidagi qutb burchagi φ ning **π/8** qadam bilan [0,2π] kesmadagi qiymatlari asosida ***r*** ning qiymatlarini topamiz:

φ	0	π/8	π/4	3π/8	π/2	5π/8
r	a	$a\sqrt{2}/2$	0	$-a\sqrt{2}/2$	- a	$-a\sqrt{2}/2$
φ	3π/4	7π/8	π	9π/8	5π/4	11π/8
r	0	$a\sqrt{2}/2$	a	$a\sqrt{2}/2$	0	$-a\sqrt{2}/2$
φ	3π/2	13π/8	7π/4	15π/8	2π	
r	- a	$-a\sqrt{2}/2$	0	$a\sqrt{2}/2$	a	

Bu qiymatlar qutb koordinatalar sistemasida quriladigan egri chiziq nuqtalarining koordinatalarini aniqlaydi, ularni quyidagicha quramiz(buning uchun 1.4.10-rasmdagi nuqtani qurish qoidasini eslash o‘rinli). 2.2.6.1-rasmda (*a*;0) nuqtadan boshlab chiziq ustida ko‘rsatilgan yo‘nalish bo‘yicha:

$(a\sqrt{2}/2,\ \pi/8),\ (0;\pi/4),\ (-a\sqrt{2}/2;3\pi/8),(-a;\pi/2),\ldots,(a\sqrt{2}/2;15\pi/8),(0;2\pi)$

nuqtalarni ketma-ket aniqlaymiz va ularni tutashtiramiz.



1-rasm.

Topilgan koordinatalari asosida nuqtalarni va egri chiziqni qutb koordinatalar sistemasida animatsiya yordamida qurish(2-rasm) dasturi:

M a p l e d a s t u r i:

```
> restart; with(plots):

> a:= plot(4*cos(2*x),x=1..16,coords=polar, thickness=3):

> b:= coordplot(polar,[0..5,0..2*Pi],labelling=true):

> [seq([4*cos(2*Pi*x/8),Pi*x/8],x=1..16 )];
```

$$\left[\left[2\sqrt{2}, \frac{1}{8}\pi\right], \left[0, \frac{1}{4}\pi\right], \left[-2\sqrt{2}, \frac{3}{8}\pi\right], \left[-4, \frac{1}{2}\pi\right], \left[-2\sqrt{2}, \frac{5}{8}\pi\right], \left[0, \frac{3}{4}\pi\right], \left[2\sqrt{2}, \frac{7}{8}\pi\right], [4, \pi], \left[2\sqrt{2}, \frac{9}{8}\pi\right], \left[0, \frac{5}{4}\pi\right], \left[-2\sqrt{2}, \frac{11}{8}\pi\right], \left[-4, \frac{3}{2}\pi\right], \left[-2\sqrt{2}, \frac{13}{8}\pi\right], \left[0, \frac{7}{4}\pi\right], \left[2\sqrt{2}, \frac{15}{8}\pi\right], [4, 2\pi]\right]$$

```
> rf:=seq([evalf(4*cos(2*Pi*x/8)),Pi*x/8 ],x=1..16);
```

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$$rf := \left[2.828427124, \frac{1}{8}\pi\right], \left[0., \frac{1}{4}\pi\right], \left[-2.828427124, \frac{3}{8}\pi\right], \left[-4., \frac{1}{2}\pi\right], \left[-2.828427124, \frac{5}{8}\pi\right], \left[0., \frac{3}{4}\pi\right], \left[2.828427124, \frac{7}{8}\pi\right], [4., \pi], \left[2.828427124, \frac{9}{8}\pi\right], \left[0., \frac{5}{4}\pi\right], \left[-2.828427124, \frac{11}{8}\pi\right], \left[-4., \frac{3}{2}\pi\right], \left[-2.828427124, \frac{13}{8}\pi\right], \left[0., \frac{7}{4}\pi\right], \left[2.828427124, \frac{15}{8}\pi\right], [4., 2\pi]$$

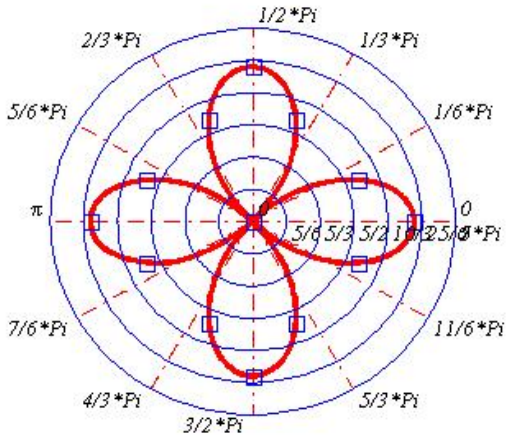
> Nuqtalar:=pointplot([rf[1], rf[2], rf[3], rf[4], rf[5], rf[6], rf[7], rf[8],

rf[9], rf[10], rf[11], rf[12], rf[12], rf[13], rf[14], rf[15], rf[16]],

color= blue, thickness=5, symbol = box, symbolsize = 25, coords=polar);

$Nuqtalar := PLOT(\ldots)$

> display([a,b],Nuqtalar,view=[-7..7,-7..7]);



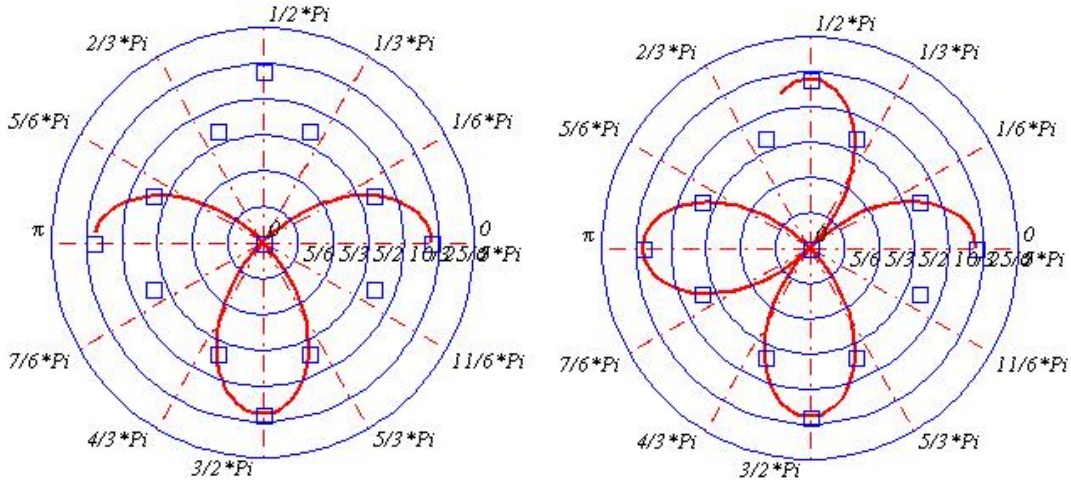
2-rasm.

Egri chiziqni qutb koordinatalar sistemasida animatsiya yordamida qurish(3-rasm).

> Ech:=animatecurve([4*cos(2*x),x,x=0..2*Pi], coords=polar, frames=60, numpoints=100,thickness=2);

$Ech := PLOT(\ldots)$

> display([a,b],Nuqtalar,Ech,view=[-6..6,-6..6]);



3-rasm.

2. Dekart koordinatalar sistemasidagi tenglamasini aniqlash. Qutb koordinatalar sistemasidagi $r = a\cos 2\varphi$ egri chiziq tenglamasi mos dekart koordinatalar sistemasidagi tenglamasini aniqlash uchun bu sistemalarni bog‘lovchi

$$r = \sqrt{x^2 + y^2},\quad \cos\varphi = \frac{x}{\sqrt{x^2 + y^2}},\quad \sin\varphi = \frac{y}{\sqrt{x^2 + y^2}},\quad tg\varphi = \frac{y}{x}.$$

formulalardan foydalanish uchun berilgan tenglamani $\cos\varphi, \sin\varphi$ lar bilan ifodalab,

$$r = a\cos 2\varphi = a(\cos^2\varphi - \sin^2\varphi)$$

ko‘rinishda yozamiz va bundan dekart koordinatalar sistemasidagi tenglamasini quyidagicha topamiz:

$$\pm\sqrt{x^2 + y^2} = a\ \frac{x^2}{x^2 + y^2} - \frac{y^2}{x^2 + y^2}\ = a\frac{x^2 - y^2}{x^2 + y^2}$$

$$(x^2 + y^2)^3 = a^2(x^2 - y^2)^2.$$

M a p l e d a s t u r i:

> restart;

> subs(r=sqrt(x^2+y^2),cos(t)=x/sqrt(x^2+y^2), sin(t)=y/sqrt(x^2+y^2), r=a(cos(t)^2–sin(t)^2));

$$\sqrt{x^2 + y^2} = a\left(\frac{x^2}{x^2 + y^2} - \frac{y^2}{x^2 + y^2}\right)$$

> simplify(%); $\sqrt{x^2+y^2} = a\left(\frac{x^2-y^2}{x^2+y^2}\right)$

Olingan natijalarni tahlil qilish. Malpe tizimi Oliy matematikaning analitik geometriya va matematik analiz sohalarida masalalarni tez, aniq va sifatli yechish uchun ishlatilishi mumkin, shuningdek, 2D va 3D formatlarida animatsion grafikalar va raqamlarni o'z ichiga olgan muhandislik masalalarini hal qilish imkonini beradi [1,2,3].

Xullosa. Bugungi kunda kompyuter yordamida ko‘plab masalalarni, matematik modulini tuzishda va bu masalalarni katta tezlikda hal qilishga xizmat qiluvchi Maple matematik paketi mavjud bo‘lib, murakkab geometri shaki va grafiklarni 2D va 3D farmatlarida tez, aniq va sifatli tasvirlashda Maple tizimi dasturlaridan foydalanish qulay va samarali ekanligi ko‘ramiz[7,8].

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