

**MAPLE TIZIMIDA IKKINCHI TARTIBLI SIRTЛАRNI KESISHISH CHIZIQLARINI ANIQLASH
VA ORTOGONAL PROYEKSIYALARINI QURISH**

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Anotatsiya. *Ushbu maqolada muxandislik masalalarini yechishda zamonaviy Maple paketidan foydalanib yechimni tez va sifatli topish hamda geometrik shakillarni 2D va 3D formatida sifatli va aniq tasvirlashga, shuningdek "Muhandislik va kompyuter grafikasi" fanini o'qitishda kesishuvchi ikkinchi tartibli sirtlarning koordinatalar tekisliklaridagi proyeksiyalarini Maple dasturi asosiri qurishga bag'ishlangan.*

Kalit so'zlar. *Poyeksiya, ortogonal, to'g'ri burchak, perpendikulyar, Monj chizmasi, frontal, profil, plots, intersectplot, implicitplot3d, display, translate.*

**ОПРЕДЕЛЕНИЕ ЛИНИЙ ПЕРЕСЕЧЕНИЯ ПОВЕРХНОСТЕЙ ВТОРОГО ПОРЯДКА И
ПОСТРОЕНИЕ ИХ ОРТОГОНАЛЬНЫХ ПРОЕКЦИЙ В СИСТЕМЕ MAPLE**

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Аннотация. *Статья посвящена использованию современного пакета Maple при решении инженерных задач для быстрого и качественного поиска решения и качественного и точного изображения геометрических фигур в 2D и 3D формате, а также построению основ программы Maple для проецирования пересекающихся поверхностей второго порядка на координатные плоскости в рамках преподавания предмета «Инженерная и компьютерная графика».*

Ключевые слова: Проекция, ортогональная, прямой угол, перпендикулярная, чертёж Монжа, фронтальная, профильная, графики, *intersectplot*, *implicitplot3d*, отображение, перевод.

DETERMINING THE LINES OF INTERSECTION OF SECOND-ORDER SURFACES AND CONSTRUCTING THEIR ORTHOGONAL PROJECTIONS IN THE MAPLE SYSTEM

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Abstract. *This article explores the use of the modern Maple software package in solving engineering problems for fast and high-quality solution searches and high-quality, accurate representation of geometric figures in 2D and 3D. It also explores the foundations of a Maple program for projecting intersecting quadratic surfaces onto coordinate planes as part of the course "Engineering and Computer Graphics."*

Keywords: *Projection, orthogonal, right angle, perpendicular, Monge plot, frontal, profile, graphs, intersectplot, implicitplot3d, mapping, translation.*

KIRISH

Geometrik jisimning to'liq ko'rinishini tasavvur qilish, jisim shaklini ko'z oldiga keltirish uchun koordinata tekisliklaridagi proyeksiyalarini aniqlash zarur bo'ladi[2,8].

Fazoda jisimning ortogonal proyeksiyasining qoidasiga asosan jismni proyeksiyalovchi parallel nurlar proyeksiyalar tekisligiga perpendikulyar bo'lganligi uchun bunday parallel proeksiyalash *to'g'ri burchakli yoki ortogonal proyeksiyalash* bo'ladi[3,7].

Jisimni yaqqolroq tasavvur qilishda, uning o'lchamlarini va elementlarini qulay holda tasvirlash uchun jisimning ortogonal proyeksiyalarini o'zaro perpendikulyar tekisliklarda aniqlanadi. Bu usulni birinchi bo'lib fransuz injeneri va matematigi Gaspar Monj(1746–1818) tomonidan sistemalashtirilgan. Shuning uchun bu usulni *Monj usuli* deb ataladi, hosil bo'lgan chizmani esa *Monj chizmasi* deb yuritiladi[2,3].

Asosiy qism. Bu bo'limida ba'zibir masalalarni yechishda geometrik tasavvur uchun muhim bolgan, ikkinchi tartibli sirtlar va ularning kesishishdan hosil bo'lgan chiziqlarning ortogonal proyeksiyalarini topishni o'rganamiz. Buning uchun quyidagi masalani Maple dasturi yordamida yechimini topish yo'llarini ko'rsatamiz[5,6,8,9].

$$z = 3 - 3\sqrt{x^2 + y^2} / 2 \text{ konus va } (z+1)^2 / 4 + x^2 / 6 = 1 \text{ slindr kesishish chizig'ining}$$

proyeksiyalarini $Oxyz$ va $OVNW$ sistemalarning koordinata tekisliklarida qurishning Maple dasturini tuzamiz.

1) sirtlarning kesishishidan hosil bo'lgan chiziqni aniqlash (1-rasm):

Maple dasturi:

```
> restart; with(plots):with(plots,intersectplot):
```

```
> with(plottools): map(with,[plots,plottools]):
```

```
> p1:=implicitplot3d([x^2/6+(z+1)^2/4=1,z=3-3/2* sqrt(x^2+y^2)],x=-5..5,y=-5..5,z=-4..4, grid=[13,13,13]);
```

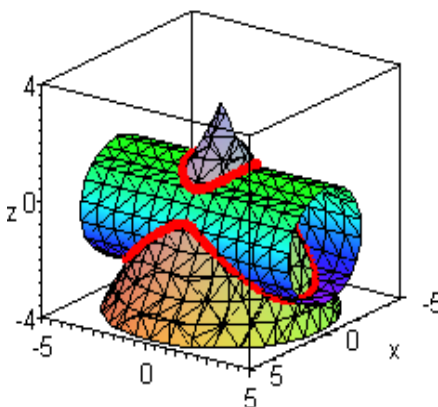
```
> p2:=intersectplot(x^2/6+(z+1)^2/4=1,z=3-3/2* sqrt(x^2+y^2),x=-5..5, y=-5..5, z=-4..4,
```

```
axes=box, thickness=3, orientation=[70,40]);
```

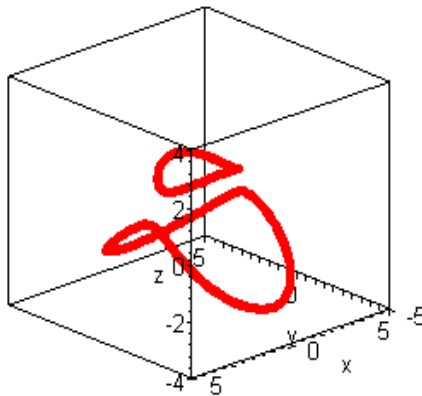
```
> plots[display]([p1,p2], orientation=[37,62]);
```

2) sirtlarning kesishish chini ajiratish (2-rasm):

```
> plots[display]([p2], orientation=[37,62]);
```



1-rasm.



2-rasm.

3) sirtlarni va kesishish chiziqlarining proyeksiyalarini $Oxyz$ koordinatalar tekisliklarida aniqlash va qurish (3-rasm):

```
> SJI:=plots[display]([p1,p2],orientation=[37,62]);
```

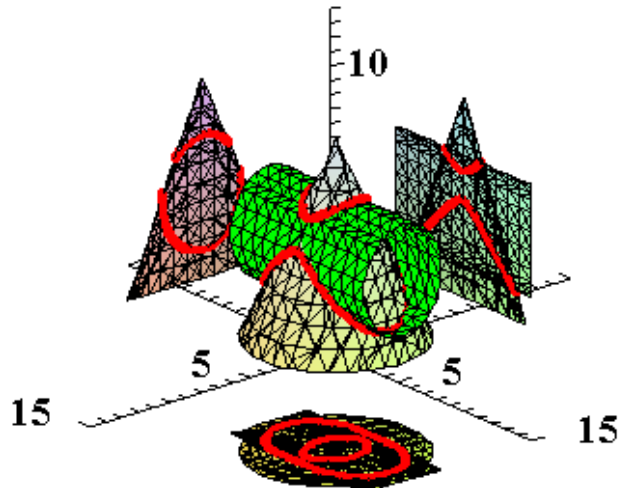
```
> KOCHr1:=translate(SJI, 8,10,8):
```

```
> map(with,[plots,plottools]):F:=[TIMES,BOLD,18]:
```

```
> Oyz:=[[0,0,0],[0,10,0],[0,0,10]]:
```

```
Oxy:=[[0,0,0], [0,10,0],[10,0,0]]: Oxz:=[[0,0,0],[10,0,0],[0,0,10]]:
```

```
> display(KOCHr1,project(KOCHr1,Oyz), project(KOCHr1, Oxy), project(KOCHr1,Oxz), orientation=[34,49], axes=normal, axesfont=F, view=[-15..15,-15..15, 0..10]);
```



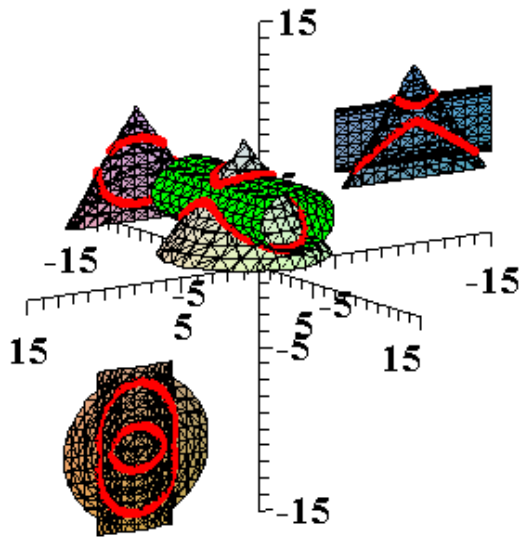
3–rasm.

4) sirlarni va kesishish chiziqlarining proyeksiyalarini OVNW koordinatalar tekisliklarida aniqlash va qurish(4–rasm):

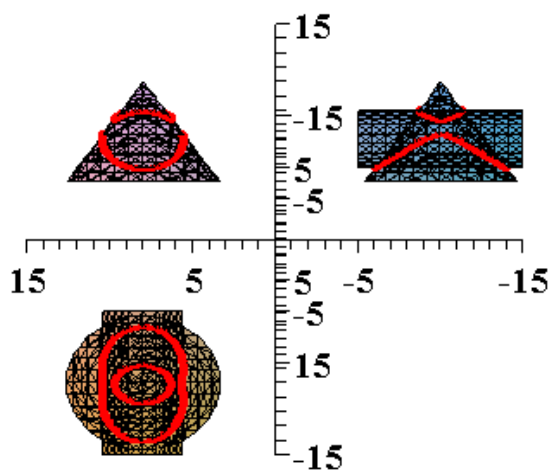
```
> Pyz:= project(KOCHr1,Oyz): Pxy:=project(KOCHr1,Oxy):
  Pxz:=project(KOCHr1,Oxz):
> rxy := rotate(Pxy,Pi/2,0,0):
  ryz := rotate(Pyz,0,0,3*Pi/2):
> display(KOCHr1,Pxz,rxy,ryz,orientation=[50,73], axes=normal, axesfont=F,view=[-15..15,-15..15,-15..15]);
```

5) sirlarni kesishish chiziqlarining proyeksiyalarini OVNW koordinatalar tekisliklarida aniqlash va qurish(5–rasm):

```
> display(Pxz,rxy,ryz,orientation=[90,60],axes=normal, axesfont=F, view=[-15..15,-15..15,-15..15]);
```



4–rasm.



5–rasm.

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 formatlarida tez, aniq va sifatli tasvirlashda Maple tizimi dasturlaridan foydalanish qulay va samarali ekanligi ko'ramiz[1,2,3,9].

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