Ray tracing

Příklad trojúhelníková ploška 1

```
PA = [50,100,35];
PB = [20,60,30];
PC = [70,80,40];

a = 0.5;
b = 0.3;
c = 0.2;

P = a*PA + b*PB + c*PC
```

```
P = 1×3
   45.0000   84.0000   34.5000
```

Příklad trojúhelníková ploška 2

```
PA = [50,100,35];
PB = [20,60,30];
PC = [70,80,40];

P1 = [0,0,0];
P2 = [25.5 39 18];

D = det([PA'-PB' PA'-PC' P2'-P1']);

b = det([PA'-P1' PA'-PC' P2'-P1'])/D
```

```
b = 0.3000
```

```
c = det([PA'-PB' PA'-P1' P2'-P1'])/D
```

```
c = 0.5000
```

```
a = 1 - b - c
```

```
a = 0.2000
```

```
t = det([PA'-PB' PA'-PC' PA'-P1'])/D
```

```
t = 2
```

```
P = a*PA + b*PB + c*PC
```

```
P = 1×3
    51    78    36
```

Příklad koule

```
P1 = [0,0,0];
P2 = [25.5 39 18];

r=50;
S = [50,60,20];

A = sum((P2-P1).^2)
```

```
A = 2.4953e+03
```

```
B = sum(2*(P2-P1).*(P1-S))
```

```
B = -7950
```

```
C = sum(P1.^2) + 2*sum(S.*P1) + sum(S.^2) - r^2
```

```
C = 4000
```

```
t1 = (-B+sqrt(B^2-4*A*C))/(2*A)
```

```
t1 = 2.5598
```

```
t2 = (-B-sqrt(B^2-4*A*C))/(2*A)
```

```
t2 = 0.6262
```

```
S1 = P1 + (P2-P1)*t1
```

```
S1 = 1×3
   65.2754   99.8330   46.0768
```

```
S2 = P1 + (P2-P1)*t2
```

```
S2 = 1×3
   15.9690   24.4231   11.2722
```

Priklad box

```
P1 = [0,2];
P2 = [2,3];

box = [10 5;
       20 10];

ts = (box(1,:) - P1) ./ (P2 - P1)
```

```
ts = 1×2
     5     3
```

```
te = (box(2,:) - P1) ./ (P2 - P1)
```

```
te = 1×2
    10     8
```

```
t = [max(ts),min(te)]
```

```
t = 1×2
     5     8
```

```
P1 = [30,0,0];
P2 = [0 50 20];

box = [15 10 5;
       45 20 20];

smer = (P2 - P1) > 0
```

```
smer = 1×3 logical array
   0   1   1
```

```
ts = (box(1,:) - P1) ./ (P2 - P1)
```

```
ts = 1×3
    0.5000    0.2000    0.2500
```

```
te = (box(2,:) - P1) ./ (P2 - P1)
```

```
te = 1×3
   -0.5000    0.4000    1.0000
```

```
tl = te;
tu = ts;

tl(smer) = ts(smer);
tu(smer) = te(smer);

tl
```

```
tl = 1×3
   -0.5000    0.2000    0.2500
```

```
tu
```

```
tu = 1×3
    0.5000    0.4000    1.0000
```

```
t = [max(tl),min(tu)]
```

```
t = 1×2
    0.2500    0.4000
```

Reflexion

```
primka = [0 0 ; 5 10];
I = [30 10]
```

```
I = 1×2
    30    10
```

```
In = I/norm(I)
```

```
In = 1×2
    0.9487    0.3162
```

```
P = (primka(2,:) - primka(1,:))/norm(primka(2,:) - primka(1,:))
```

```
P = 1×2
    0.4472    0.8944
```

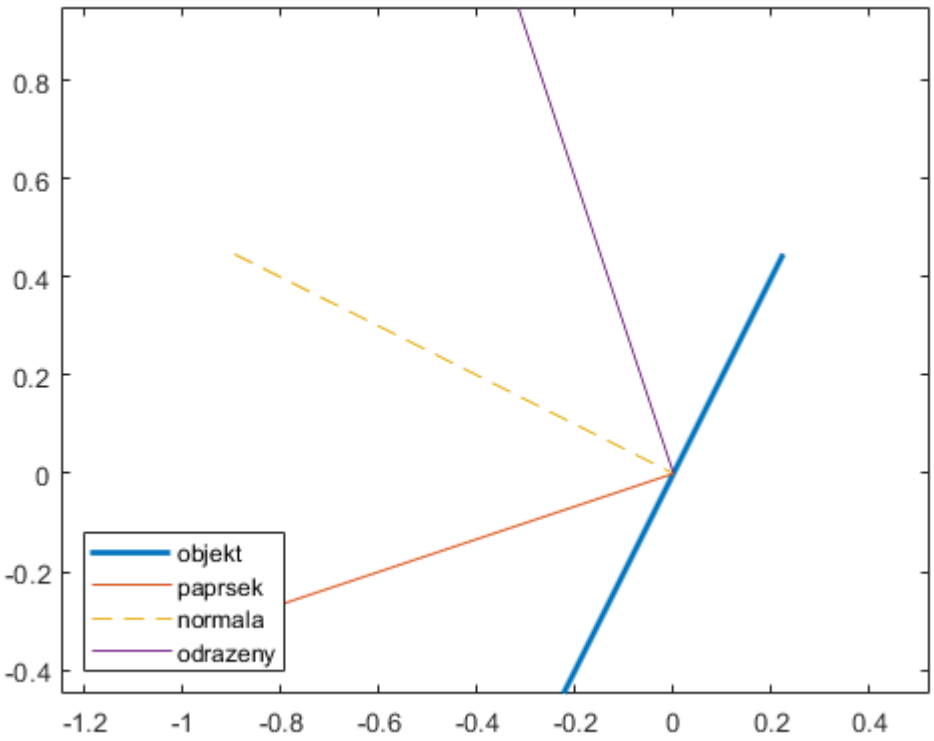
```
N = [P(2) -P(1)]/norm([P(2) -P(1)])
```

```
N = 1×2
    0.8944   -0.4472
```

```
R = In - 2*(dot(In,N))*N
```

```
R = 1×2
   -0.3162    0.9487
```

```
figure,
plot([0-P(1)/2 0+P(1)/2], [0-P(2)/2 0+P(2)/2],"LineWidth",2); %objekt
hold on
plot([0-In(1) 0], [0-In(2) 0]); %paprsek
plot([0-N(1) 0], [0-N(2) 0],'--'); %normala
plot([0 0+R(1)], [0 0+R(2)]); %odrazeny
legend({'objekt','paprsek', 'normala', 'odrazeny'},'Location','southwest')
hold off
axis equal
```



Refrakce

```
etaI = 1;
etaT = 1.5;

primka = [0 0 ; 5 10];
I = [30 10]
```

```
I = 1×2
    30    10
```

```
In = I/norm(I)
```

```
In = 1×2
    0.9487    0.3162
```

```
P = (primka(2,:) - primka(1,:))/norm(primka(2,:) - primka(1,:))
```

```
P = 1×2
    0.4472    0.8944
```

```
N = [P(2) -P(1)]/norm([P(2) -P(1)])
```

```
N = 1×2
    0.8944   -0.4472
```

```
costhetaI = dot(-I,N)
```

```
costhetaI = -22.3607
```

```
costhetaT = sqrt((1-etaI^2*(1-costhetaI^2))/etaT)
```

```
costhetaT = 18.2574
```

```
T = etaI/etaT*I*((etaI/etaT)*costhetaT).*N
```

```
T = 1×2
  217.7324  -36.2887
```

```
Tn = T/norm(T);

figure,
plot([0-P(1)/2 0+P(1)/2], [0-P(2)/2 0+P(2)/2],"LineWidth",2); %objekt
hold on
plot([0-In(1) 0], [0-In(2) 0]); %paprsek
plot([0-N(1) 0+N(1)], [0-N(2) 0+N(2)], '--'); %normala
plot([0 0+Tn(1)], [0 0+Tn(2)]); %odrazeny
legend({'objekt','paprsek', 'normala', 'lomeny'},'Location','southwest')
hold off
axis equal
```