组合

三维组合

```
process3D[ky_,kx_,kL_,kh_,ks_]:=
{
gbapan,
gzhuzuo,
gchangshuzhigan,
gticksbapan,
gtickszhuzuo,
gbzqiuzuo,
fbahuan[kx],
fzhichengqiuzhu[ky],
fshuzhibiaogan[ks+3.5+2,ky],
fticksbiaogan[ks+3.5+2,ky+1],
fgaodudingweiqi[ks+3.5+2,ky+1+kh],
fbaixiangudingduan[ky+1+kL]
};
```

二维组合

```
process2D[ky_,kL_,kh_,ks_]:=
{
gpbapan,
gpzhuzuo,
gpbzqiuzuo,
fpzhichengqiuzhu[ky],
fpshuzhibiaogan[ks+3.5+2,ky],
fpgaodudingweiqi[ks+3.5+2,ky+1+kh],
fpbaixiangudingduan[ky+1+kL]
};
```

小球运动的控制

```
processBall[
ky_,kx_,kL_,kh_,ks_,km1_,km2_,e_,△Ef_,g_,t_]:=

Module[{y,x,L,h,s,m1,m2,yball1,zball1,yball2,zball2,t1,t2,t3,△h,
θ0,vq,θ,θh,fθ,v2,gbaixian,baixianfunction,gshoulifenxi},

(*单位换算*)
y=ky/100;
x=kx/100;
L=kL/100;
h=kh/100;
s=ks/100;
m1=km1/1000;
m2=km2/1000;
```

```
(*单位换算/*)

(*/微分方程与时间划分*)
△h=Chop[Sqrt[L^2-s^2]-(L-h)];
θ0=π/2-ArcSin[s/L];
t1=Sqrt[2△h/g];
vq=Sqrt[2g △h] s/L;
fθ=(θ/.NDSolve[{θ''[tx]==g/L Sin[π/2-θ[tx]],L θ'[t1]==vq,θ[t1]==θ0},
θ,{tx,t1,0.5}][[1,1]]);
θh=fθ'';
t2=t1;
While[θh[t2]>0,t2=t2+0.0001];
t3=t2+Sqrt[(2y)/g];
(*微分方程与时间划分/*)

(*/速度换算_平抛初速度*)
v2=Sqrt[2] Sqrt[-(((1+e)^2 g m1^2 m2 (-h s^2+(L-s) (L+s) (-L+
Sqrt[L^2-s^2]))+L^2 (m1+m2)^2 △Ef)/(L^2 m2 (m1+m2)^2))];
(*速度换算_平抛初速度/*)

(*/小球坐标的计算*)
yball1:=ks+2/;0<=t<=t1;
yball1:=2+kL Cos[fθ[t]]/;t1<t<=t2;
yball1:=2/;t2<t;
zball1:=kh+ky+1-100 1/2 g t^2/;0<=t<=t1;
zball1:=ky+kL+1-kL Sin[fθ[t]]/;t1<t<=t2;
zball1:=ky+1/;t2<t;
yball2:=0/;0<=t<=t2;
yball2:=-100v2(t-t2)/;t2<t<=t3;
yball2:=-100v2(t3-t2)/;t3<t;
zball2:=ky+1/;0<=t<=t2;
zball2:=ky+1-100 1/2 g (t-t2)^2/;t2<t<=t3;
zball2:=ky+1-100 1/2 g (t3-t2)^2/;t3<t;
(*小球坐标的计算/*)

(*/摆线*)
baixianfunction=fbaixian[2,ky+1+kL,yball1,zball1,kL];
gbaixian:=Line[Table[{0,i,baixianfunction[i]},{i,2,yball1,
0.1}]]/;0<=t<t2;
gbaixian:=Line[{{0,2,ky+1+kL},{0,yball1,zball1}}]/;t2<=t;
(*摆线/*)

(*/受力分析*)
gshoulifenxi:={}/;t1<0.01&&0<=t<0.01||t1>=0.01&&0<=t<=t1-
0.01||t>t1+0.01;
gshoulifenxi:=fshoulifenxi[Sqrt[2g △h],π/2-θ0,yball1,
zball1]/;t1-0.01<t<=t1+0.01&&t1>=0.01;
(*受力分析/*)

finalx=100v2(t3-t2);

(*/返回小球对象*)
Return[
{{GrayLevel[0.5],Specularity[1,50],
Sphere[{0,yball1,zball1}],
Sphere[{0,yball2,zball2}]},
gbaixian,
gshoulifenxi,
```

```
If[t>=t3,{Red,Line[{{-6,yball2,0.01},{6,yball2,0.01}}]}]
}
];
(*返回小球对象/*)
];
```

最终时间

```
finaltime[ky_,kL_,kh_,ks_]:=
Module[{△h,θ0,fθ,θh,vq,y,L,h,s,t1,t2,t3,θ},

(*/单位换算*)
y=ky/100;
L=kL/100;
h=kh/100;
s=ks/100;
(*单位换算/*)

(*/微分方程与时间划分*)
△h=Chop[Sqrt[L^2-s^2]-(L-h)];
θ0=π/2-ArcSin[s/L];
t1=Sqrt[2△h/g];
vq=Sqrt[2g △h] s/L;
fθ=(θ/.NDSolve[{θ''[tx]==g/L Sin[π/2-θ[tx]],L θ'[t1]==vq,θ[t1]==θ0},
θ,{tx,t1,0.5}][[1,1]]);
θh=fθ'';
t2=t1;
While[θh[t2]>0,t2=t2+0.0001];
t3=t2+Sqrt[(2y)/g];
(*微分方程与时间划分/*)

(*/返回结果*)
Return[t3];
(*返回结果/*)
]
```

恢复系数**e**测量实验数据处理程序

```
processe:=
Manipulate[w=Module[{u={},i,y,m1,m2},m1=m10/1000;
m2=m20/1000;y=y0/100;
For[i=1,i<=Length[data],i++,
u=Append[u,{data[[i,1]],100/(16 m1^2 y) (m1^2 (data[[i,1]]/100)^2+
2 m1 m2 (data[[i,1]]/100)^2+m2^2 ( data[[i,1]]/100)^2),data[[i,2]]}]];u];
If[ii==1,
Module[{u={},uu={},f,b,s,e,ee,x,△E0,i,y,m1,m2},
m1=m10/1000;
m2=m20/1000;
y=y0/100;
For[i=1,i<=Length[data],i++,
u=Append[u,
{1/(16 m1^2 y) (m1^2 (data[[i,1]]/100)^2+2 m1 m2 (data[[i,1]]/100)^2+
m2^2 ( data[[i,1]]/100)^2),
1/2 m2 (data[[i,1]]/(100Sqrt[(2y)/g]))^2-
1/2 m2 (data[[i,2]]/(100Sqrt[(2y)/g]))^2}];
uu=Append[u,1/(16 m1^2 y) (m1^2 (data[[i,1]]/100)^2+
2 m1 m2 (data[[i,1]]/100)^2+m2^2 ( data[[i,1]]/100)^2)]
];

f=Function[{x},Evaluate[Fit[u,{1,x},x]]];
b=Fit[u,{1,x},x][[2,1]];
e=-1+Sqrt[g m1^2 m2 (4 g m1^2 m2-b (m1+m2)^2)]/(g m1^2 m2);
△E0=Fit[u,{1,x},x][[1]];
Column[{
Show[Plot[f[x],{x,0,Max[uu]},AxesOrigin->{0,0}],ListPlot[u],
ImageSize->400],
"\n",
StringForm["恢复系数e为： ``",        NumberForm[e,{3,2}]     ],
StringForm["固定能量损失为： `` J",         ScientificForm[△E0,3]        ]
}]]]
,Column[{Style["   测量恢复系数e",{Red,20}],"\n",
Control[{{y0,0,"   y"},InputField[⌗,ImageSize->{150,20}]&}],
Control[{{m10,0,"  m1"},InputField[⌗,ImageSize->{150,20}]&}],
Control[{{ m20,0,"  m2"},InputField[⌗,ImageSize->{150,20}]&}],
Control[{{data,0,"data\n="},InputField[⌗,ImageSize->{150,200}]&}],
Row[{"     ",
Button["检查",    CreateDialog[TableForm[w,
TableHeadings->{None,{"打靶目标/cm","理论起落高度/cm","实际打靶位置/cm"}}],
WindowFrame->"Palette",WindowFloating->True]        ]
,Button["计算",If[Head[data]==List,ii=1]],
Button["重新输入",ii=0;data=0;y0=0;m10=0;m20=0;w=0],PopupWindow[Button["帮助"],
"
y 被撞球座的高度，单位为厘米；\n
m1为撞击球的质量，m2为被撞球的质量，单位都为克；\n
data为实验数据。\n
实验（测量）方法：
"

]}]}],ControlPlacement->Left,Initialization:>(ii=0;g=9.796;w=0),
Deinitialization:>FrontEndExecute[FrontEndToken["ToggleDynamicUpdating"]]
]
```