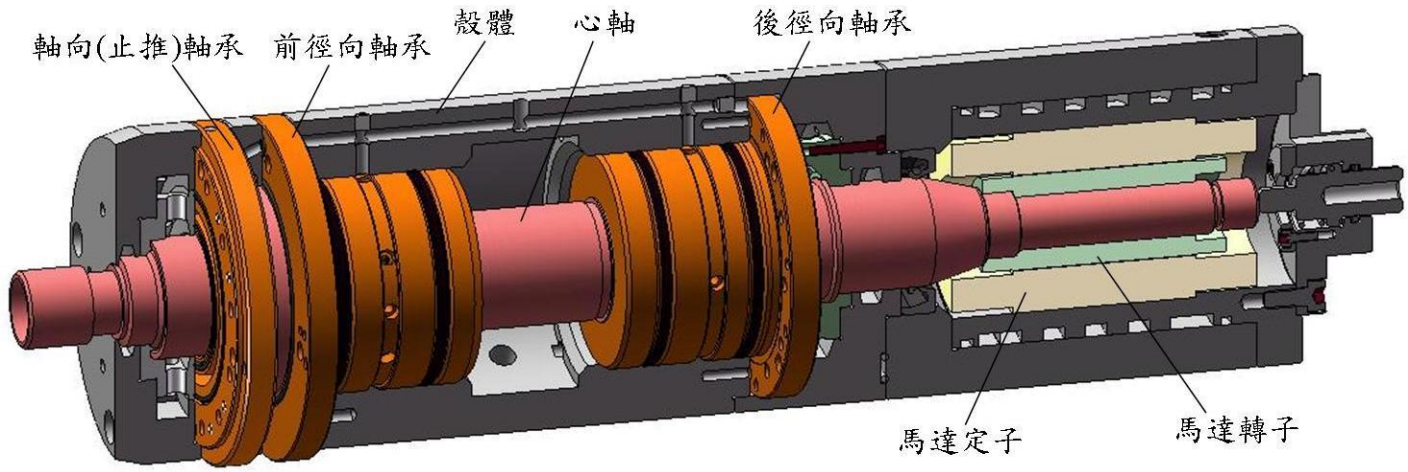
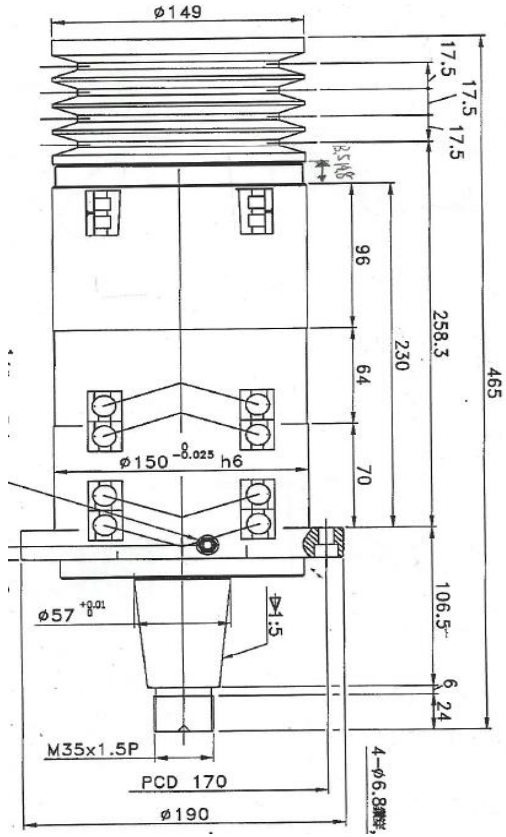
二. 液靜壓主軸設計

液靜壓主軸內部結構簡介



滾珠主軸示意圖



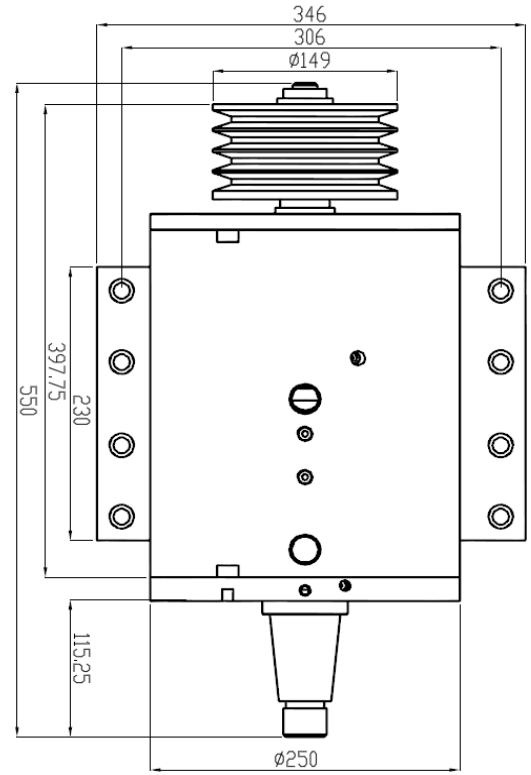
滾珠主軸相關性能表

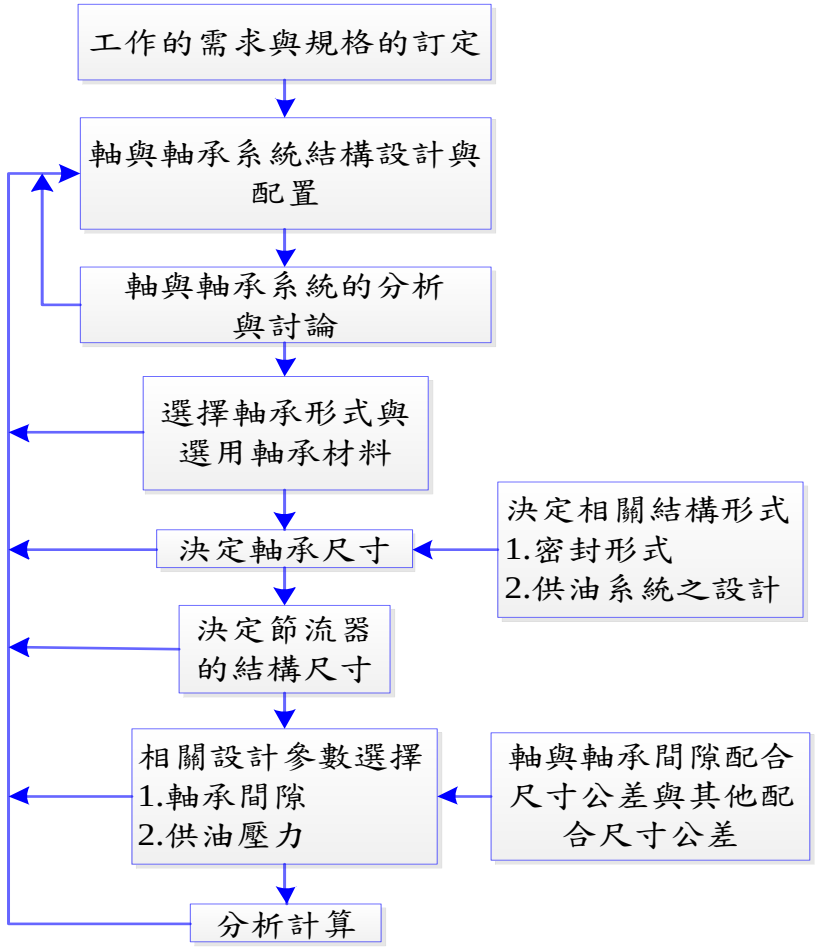
馬達功率(HP)	15
最高轉速(rpm)	3350
軸承內徑(mm)	70
靜態迴轉精度(μm)	2
徑向軸承剛性(N/um)	>180
止推軸承剛性(N/um)	>250

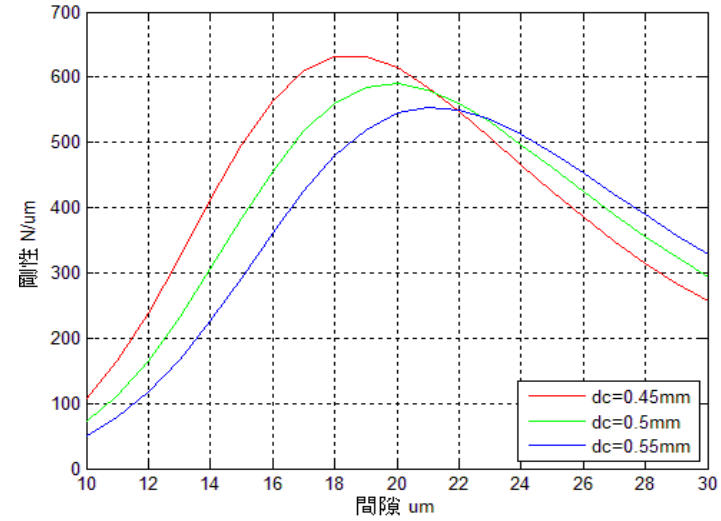
液靜壓主軸相關性能

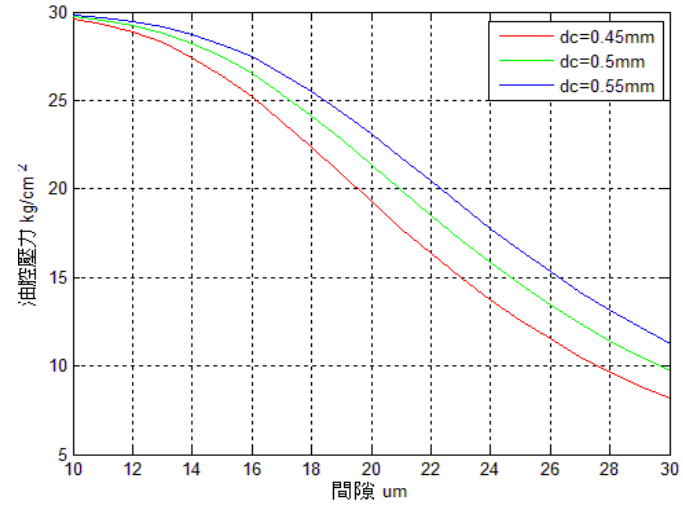
馬達功率(HP)	15
最高轉速(rpm)	3350
軸承內徑(mm)	70
靜態迴轉精度(μm)	**<1**
前徑向軸承剛性(N/um)	**930**
後徑向軸承剛性(N/um)	**340**
止推軸承剛性(N/um)	**1850**

液靜壓主軸示意圖

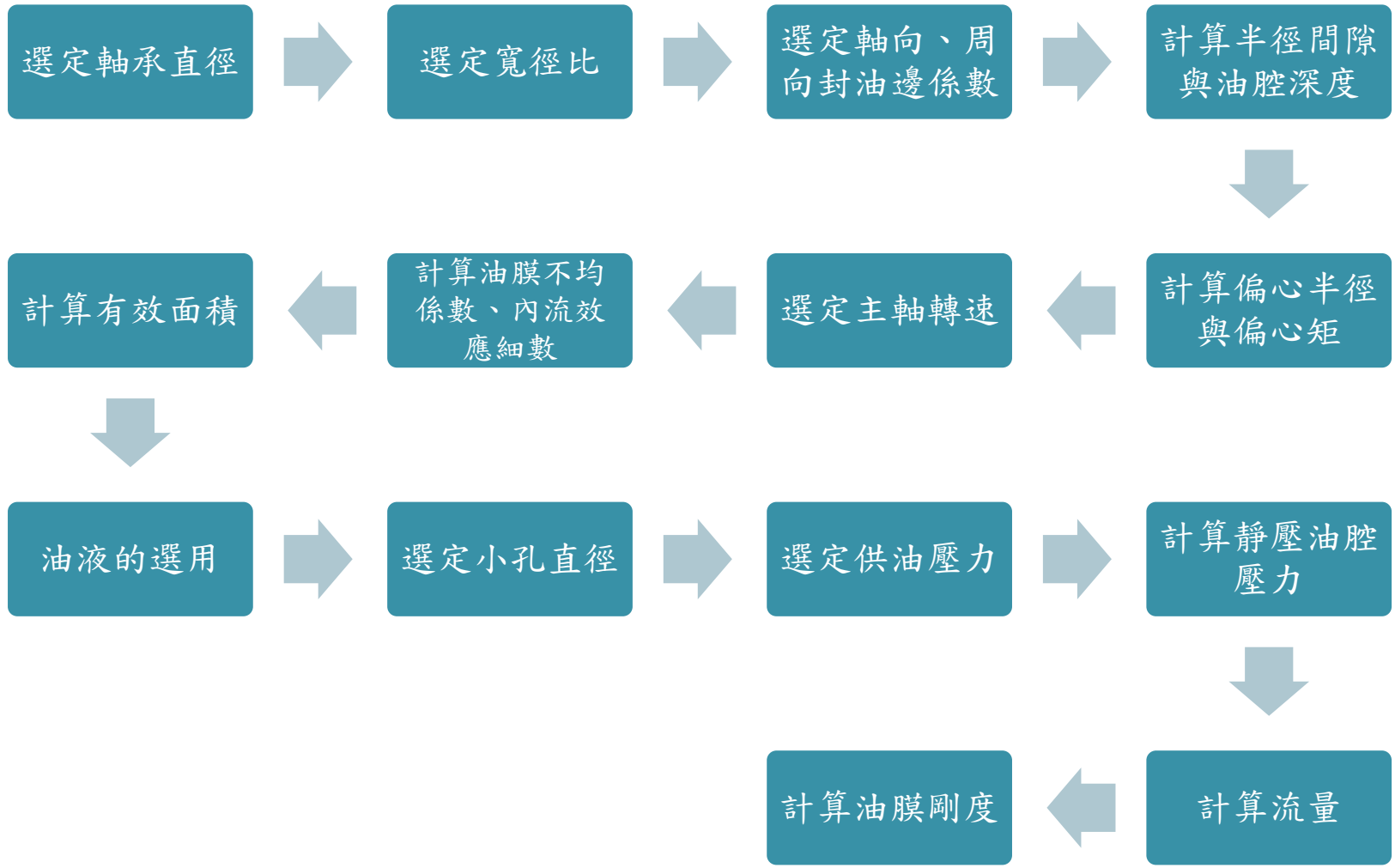



工作的需求與規格的訂定
軸與軸承系統結構設計與配置
軸與軸承系統的分析與討論
選擇軸承形式與選用軸承材料
決定軸承尺寸
決定相關結構形式
1.密封形式
2.供油系統之設計
決定節流器的結構尺寸
相關設計參數選擇
1.軸承間隙
2.供油壓力
軸與軸承間隙配合尺寸公差與其他配合尺寸公差
分析計算


剛性 N/um
間隙 um
dc=0.45mm
dc=0.5mm
dc=0.55mm

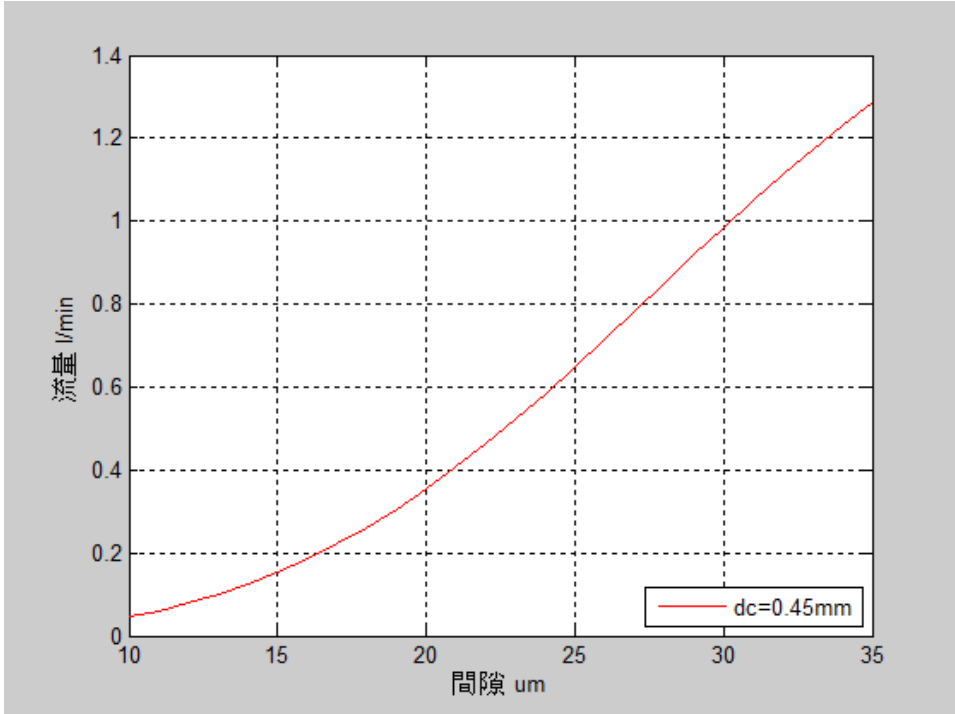

油腔壓力 kg/cm²
間隙 um
dc=0.45mm
dc=0.5mm
dc=0.55mm

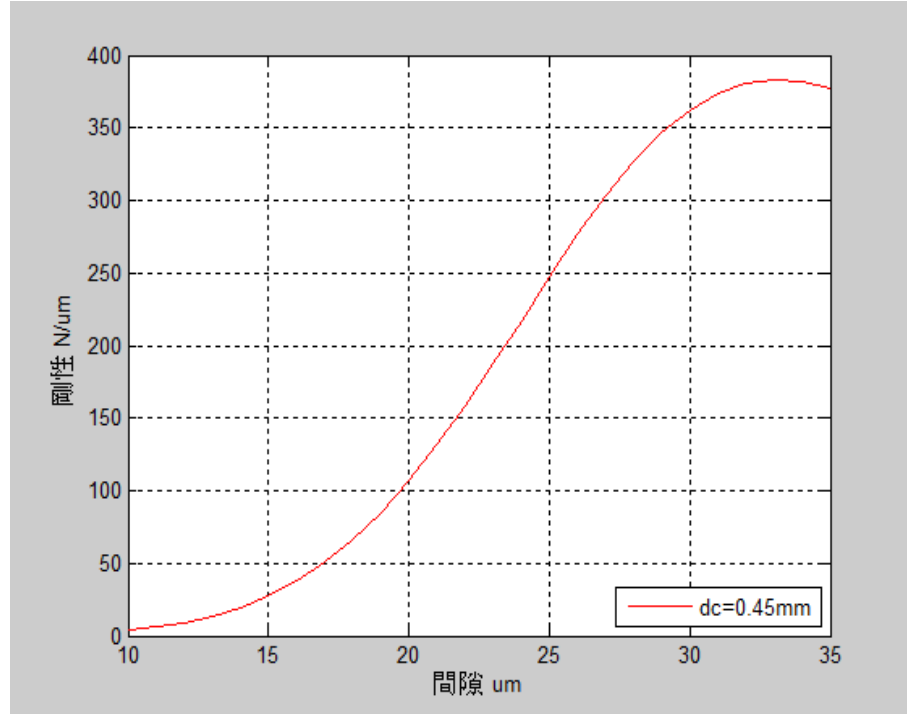
前徑向軸承(多油腔)設計



徑向軸承設計步驟

MATLAB 徑向軸承分析結果





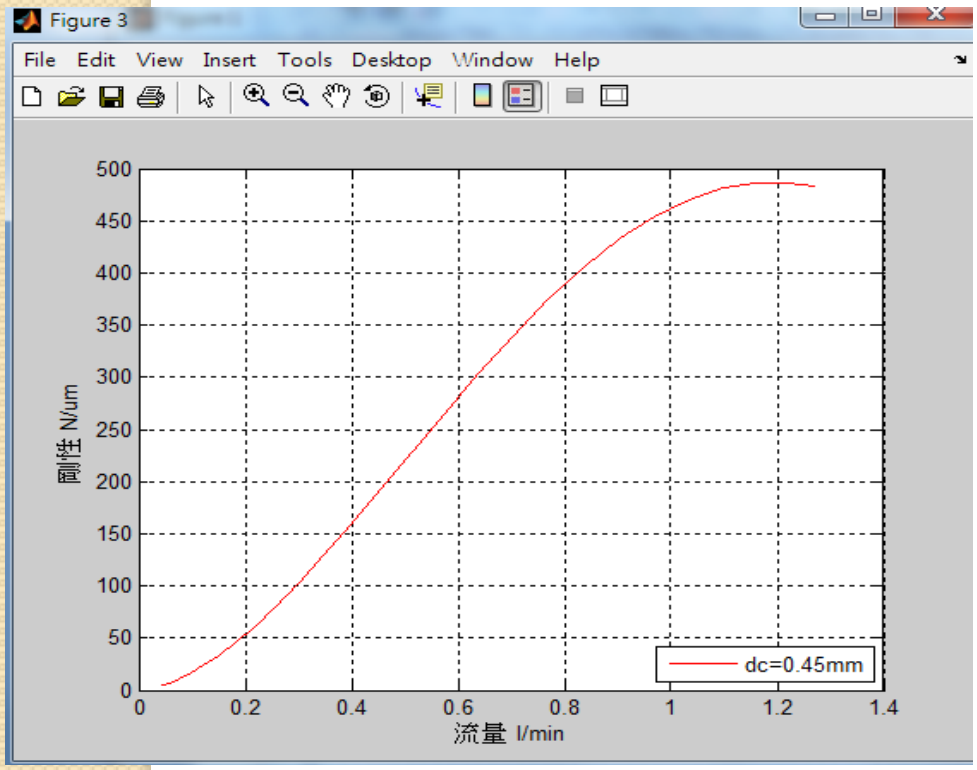


Figure 3
File Edit View Insert Tools Desktop Window Help
剛性 N/um
流量 l/min
dc=0.45mm
0
50
100
150
200
250
300
350
400
450
500
0
0.2
0.4
0.6
0.8
1
1.2
1.4

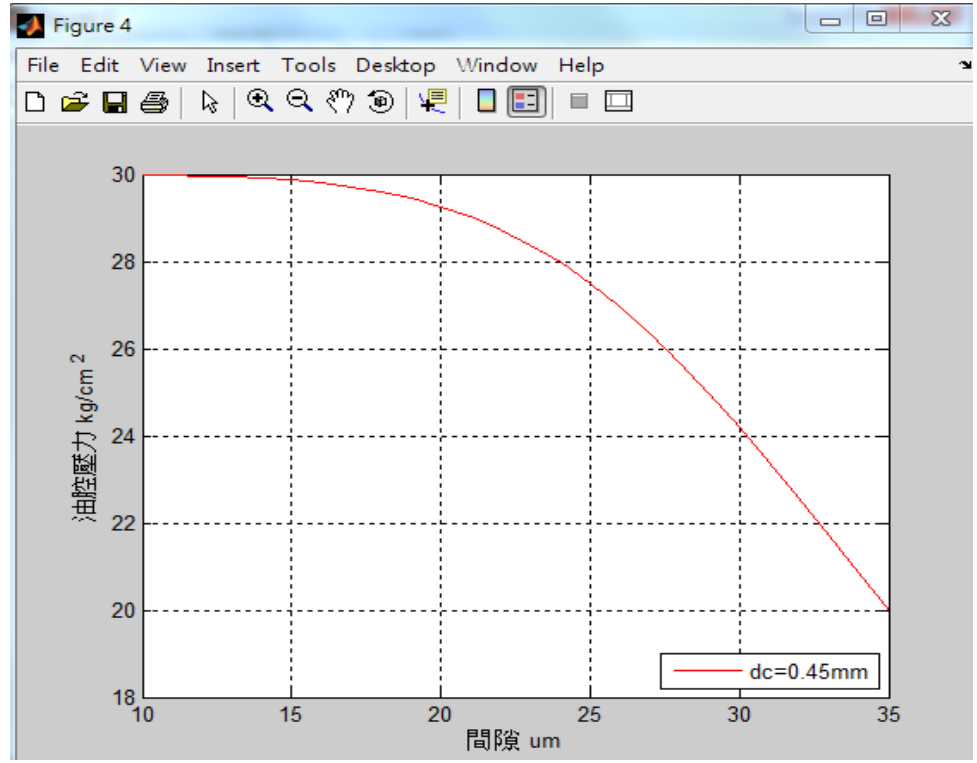
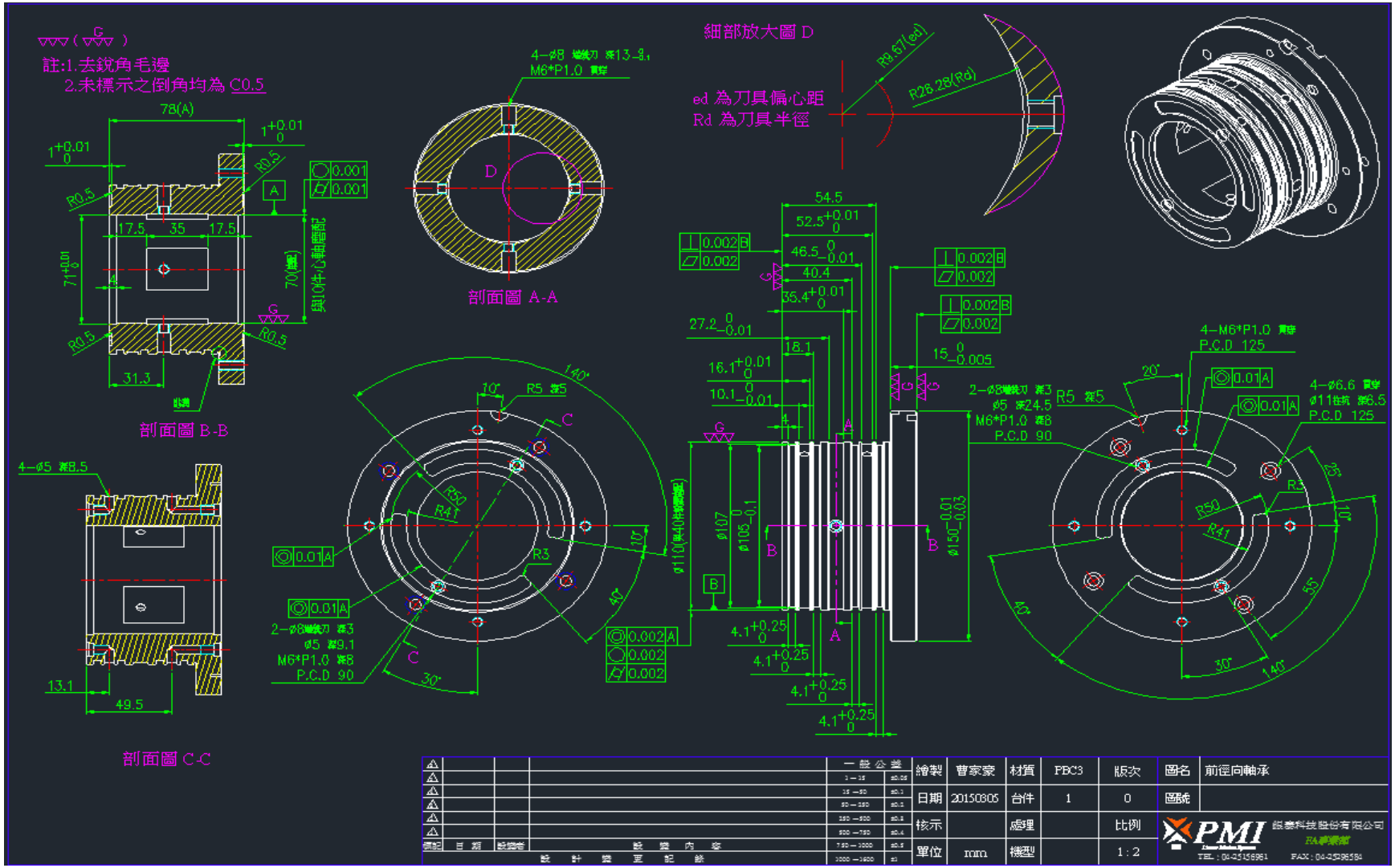


Figure 4
File Edit View Insert Tools Desktop Window Help
油腔壓力 kg/cm 2
間隙 um
dc=0.45mm
18
20
22
24
26
28
30
10
15
20
25
30
35

軸承設計參數匯入工程圖

範例:前徑向軸承尺寸設計



設計尺寸與程式數值比對

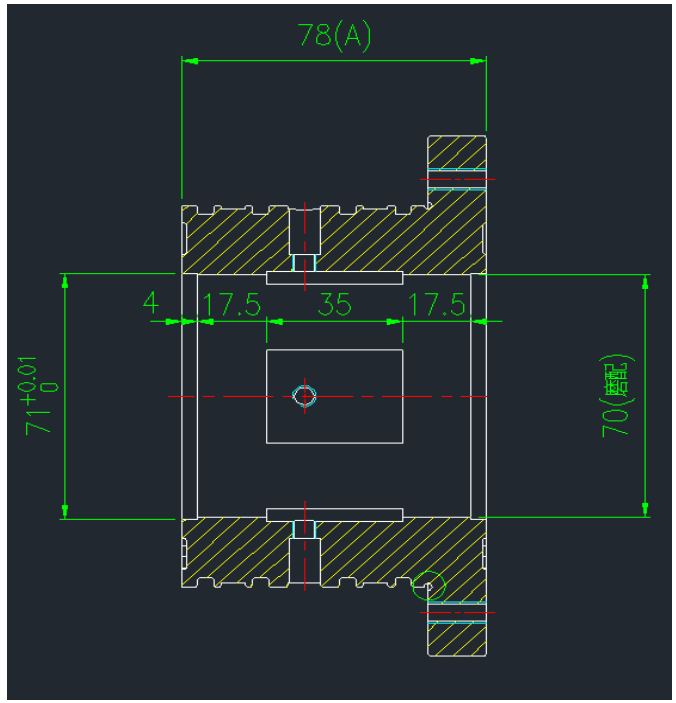
1. 由程式求解各結構尺寸。

2. 圖(1)結構尺寸B(長度)為78，兩邊配合長度單邊為4雙邊為8，扣掉配合尺寸後總長為70，與程式數值相同。

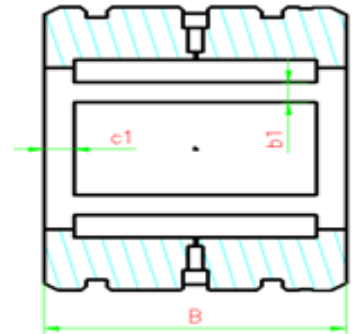
3. 圖(1)軸向封油邊係數c1為17.5，與程式數值17.5相同。

Name	Value	Min	Max
Ae	25.9862	25.98...	25.98...
Alpha	0.7000	0.7000	0.7000
B	7	7	7
Bbar	1	1	1
D	7	7	7
P0bar	<1x19 double>	0.0941	0.8476
Pr	<1x19 double>	3.7651	33.90...
Pr045	<1x19 double>	3.7651	33.90...
Pr1	<1x19 double>	-222....	-4.15...
Ps	40	40	40
Q	<1x19 double>	4.2519	10.36...
Q045	<1x19 double>	0.2551	0.6219
Q1	<1x19 double>	0.2551	0.6219
Qd	<1x19 double>	17.00...	41.46...
Qd1	<1x19 double>	1.0205	2.4877
R	3.5000	3.5000	3.5000
Rd	2.6312	2.6312	2.6312
Rho20	8.5800e-07	8.580...	8.580...
Rho50	8.3600e-07	8.360...	8.360...
S045	<1x19 double>	139.2...	1.331...
S50	<1x19 double>	139.2...	1.331...
a	<1x19 double>	0.0106	5.1123
b	2	2	2
b1	1.7500	1.7500	1.7500
b1bar	0.2500	0.2500	0.2500
c	-80	-80	-80
dc	0.0450	0.0450	0.0450

(2). 程式求解數值(cm)



(1). 設計尺寸(mm)

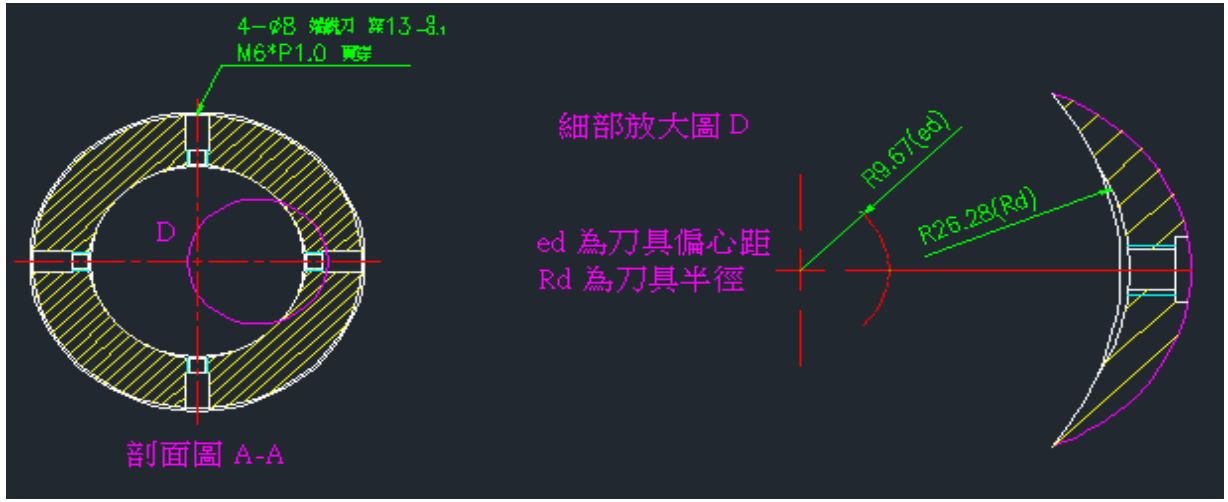


參考代號

4. 由程式可計算出刀具偏心矩(ed)及刀具半徑(Rd)。

5. 圖(1)中，刀具偏心矩(ed)尺寸為R=9.67 ，與程式數值R=9.688相近。

6. 圖(1)中，刀具半徑(Rd)尺寸為R=26.28 ，與程式數值R=26.312相近。



(1). 設計尺寸(mm)

Ae	25.9862	25.98...	25.98...
Alpha	0.7000	0.7000	0.7000
B	7	7	7
Bbar	1	1	1
D	7	7	7
P0bar	<1x19 double>	0.0941	0.8476
Pr	<1x19 double>	3.7651	33.90...
Pr045	<1x19 double>	3.7651	33.90...
Pr1	<1x19 double>	-222....	-4.15...
Ps	40	40	40
Q	<1x19 double>	4.2519	10.36...
Q045	<1x19 double>	0.2551	0.6219
Q1	<1x19 double>	0.2551	0.6219
Qd	<1x19 double>	17.00...	41.46...
Qd1	<1x19 double>	1.0205	2.4877
R	3.5000	3.5000	3.5000
Rd	2.6312	2.6312	2.6312
Rho20	8.5800e-07	8.580...	8.580...
Rho50	8.3600e-07	8.360...	8.360...
S045	<1x19 double>	139.2...	1.331...
S50	<1x19 double>	139.2...	1.331...
a	<1x19 double>	0.0106	5.1123
b	2	2	2
b1	1.7500	1.7500	1.7500
b1bar	0.2500	0.2500	0.2500
c	-80	-80	-80
dc	0.0450	0.0450	0.0450
ed	0.9688	0.9688	0.9688
h0	<1x19 double>	1.000...	0.0028
n	2890	2890	2890
t	0.1000	0.1000	0.1000
theta	0.7854	0.7854	0.7854
theta1	0.3927	0.3927	0.3927
theta1bar	0.2500	0.2500	0.2500
u20	3.8800e-08	3.880...	3.880...
u50	1.6700e-08	1.670...	1.670...
xi	0.9003	0.9003	0.9003
zeta	0.6079	0.6079	0.6079

(2). 程式求解數值(cm)

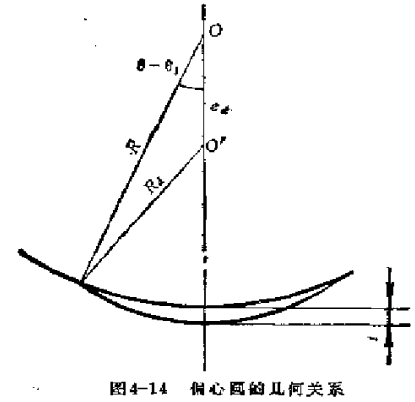
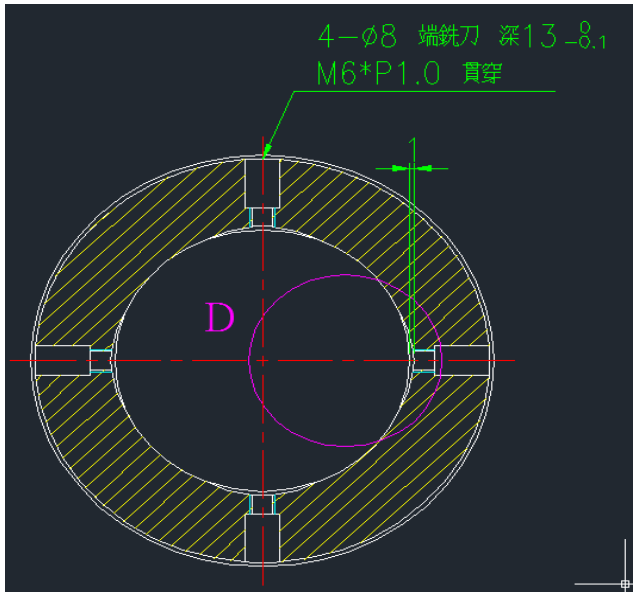


圖4-14 偏心圓銷几何关系

參考代號

7. 由程式可計算油腔深度(t) 。

8. 圖(1)中，油腔深度(t)尺寸為t = 1.0 ，與程式數值t = 1.0 相同。



(1). 設計尺寸(mm)

Ae	25.9862	25.98...	25.98...
Alpha	0.7000	0.7000	0.7000
B	7	7	7
Bbar	1	1	1
D	7	7	7
P0bar	<1x19 double>	0.0941	0.8476
Pr	<1x19 double>	3.7651	33.90...
Pr045	<1x19 double>	3.7651	33.90...
Pr1	<1x19 double>	-222....	-4.15...
Ps	40	40	40
Q	<1x19 double>	4.2519	10.36...
Q045	<1x19 double>	0.2551	0.6219
Q1	<1x19 double>	0.2551	0.6219
Qd	<1x19 double>	17.00...	41.46...
Qd1	<1x19 double>	1.0205	2.4877
R	3.5000	3.5000	3.5000
Rd	2.6312	2.6312	2.6312
Rho20	8.5800e-07	8.580...	8.580...
Rho50	8.3600e-07	8.360...	8.360...
S045	<1x19 double>	139.2...	1.331...
S50	<1x19 double>	139.2...	1.331...
a	<1x19 double>	0.0106	5.1123
b	2	2	2
b1	1.7500	1.7500	1.7500
b1bar	0.2500	0.2500	0.2500
c	-80	-80	-80
dc	0.0450	0.0450	0.0450
ed	0.9688	0.9688	0.9688
h0	<1x19 double>	1.000...	0.0028
n	2890	2890	2890
t	0.1000	0.1000	0.1000
theta	0.7854	0.7854	0.7854
theta1	0.3927	0.3927	0.3927
theta1bar	0.2500	0.2500	0.2500
u20	3.8800e-08	3.880...	3.880...
u50	1.6700e-08	1.670...	1.670...
xi	0.9003	0.9003	0.9003
zeta	0.6079	0.6079	0.6079

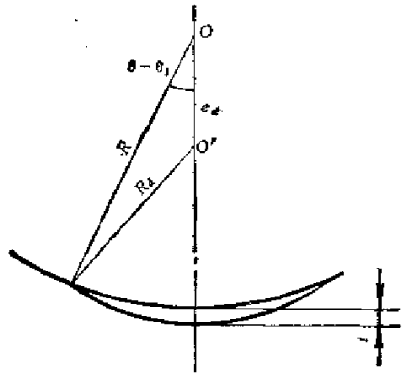


图4-14 偏心圆的几何关系

參考代號