逢甲大學學生報告 ePaper

報告題名：

齒輪輔助程式設計
Gear aid programming

作者：吳宗叡、林昱辰、陳柏叡

系級：機械與電腦輔助工程學系

學號：D0176139、D0135398、D0176302

開課老師：朱智義

課程名稱：機械設計

開課系所：機械與電腦輔助工程學系

開課學年： 103 學年度 第 2 學期

中文摘要

　　在機械設計課程，朱智義老師給我們主題就是要設計減速機，而在設計減速機中，我們發現在齒輪計算上是相當的複雜，而每當一組數據改變，就要從頭算，因此我們決定來設計一個齒輪設計軟體，來減少預算的過程，而我們一開始先用手算把一組數據算出來，再來就把怎個運算過程記錄起來，開始和同學討論我們的程式架構。

　　圖形化使用者介面上，依其功能不同而分成五大項，分別為：輸入區、訊息區、結果區、圖表區及功能區。在軟體除計算外，也會提醒使用者平常在設計上可能會忽略之問題，如輸入參數時正確之輸入值會呈現黑色，錯誤之輸入值則會呈現紅色，缺少輸入數值也會發出警告，輸入中亦顯示圖表、參數說明，以及輸出後快速比對設計結果。

　　本程式開發完成後除可以運用在機械設計上的教學應用，讓齒輪設計的初學者能快速上手，對已熟悉齒輪計算的工程師來說可以更有效率地進行數學的演算與檢測。此齒輪輔助設計軟體曾獲「逢甲大學第一屆精密機械專題暨應用競賽」程式設計組銀牌獎。

關鍵字：減速機設計、MATLAB 程式應用、正齒輪、斜齒輪

Abstract

In mechanical design curriculum , Prof.Zhu gave us a project is to design Gear reducer . we found that the gear calculation is quite complex , and every time a set of ata change , it is necessary recalculated , so we decided to design software to reduce he calculate process.We calculate a data,and discuss our program architecture.

In a graphical user interface, according to their different functions are divided into five ategories, as follows: input area, information area, the results, the chart area, and the bbon. Software division calculations, but also alerts the user to the usual questions may be ignored in the design, such as the right input when the input parameter value will ppear lack, enter a value error will appear red, lack of input values also warned that nter the harts, is also displayed in the parameter description and output faster than the design.

Upon completion of the program development can be applied in addition to teaching in mechanical design, make gear design beginners can quickly get started. Have been familiar with the gear calculation of engineers can more efficiently perform mathematical calculations and testing. This gear-aided design software won the "Feng Chia University cum first application of precision machinery thematic competition" Programming Group Silver Award.

Keyword：Gear reducer, MATLAB, Spur gear, Helical gear

目　次
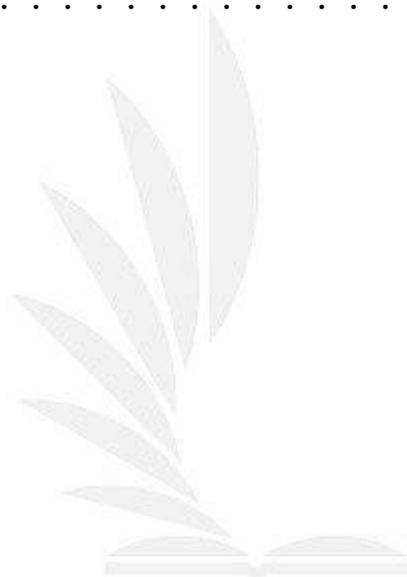
一、動機與目的

　　本專題將齒輪設計中的各算式進行有系統性的整合，讓在設計或學習齒輪這塊領域的研究人員或學生更有效率地進行數學的演算與檢測，透過此輔助設計軟體能降低人員計算的誤差也能快速地求出所需的計算精度。對於現在講求快速與精準的機械產業，許多的傳動機構皆使用齒輪，因此如何提升齒輪的精度輪越來越顯得重要。

　　此款自己撰寫出的齒輪設計輔助程式內涵壓力角、齒數、模數、轉速與功率等輸入區，除了齒型與力學的計算也包含了齒輪材料的疲勞壽命、芯部硬度、可靠度、安全係數等等，這是一個能直接用於真正使輪設計的輔助計算軟體，透過它不但減少人為計算的誤差，透過此輔助工具能大大提升工作效率。

　　對於軟體的設計架構我們使用美國 The MathWorks 公司出品之數學軟體MATLAB 進行數值計算與分析，並設圖形化使用者人性化使用者介面(GUI)，有別於在命令視窗(commond windows)進行指令式的操作，降低軟體使用門檻達到人人都可以輕鬆客製化自己齒輪的目的。而在圖形化使用者介面上依其功能不同而分成五大項，分別為：輸入區、訊息區、結果區、圖表區及功能區。

　　在軟體設計中除計算外也將許多平常在設計上可能會忽略的問題寫如程式內，如輸入參數時正確之輸入值會呈現黑色，錯誤之輸入值則會呈現紅色，若有少輸入數值時系統也會提出警告。除錯誤提醒外此程式也考慮到機械設計人員常會進行數值的比較分析，加入紀錄數據的功能，拉動下方的滑條程式就會立即呼叫資料庫中相對應之紀錄值，從中快速挑選適當之齒輪設定值。

二、齒輪的介紹

齒輪的用途很廣常被利用於動力的傳遞、改變運動方向、改變旋轉速度等機械的構件上，如減速機機構、差速機構、換向機構、起重機等。齒輪透過兩齒互咬或利用鍊條皆能傳遞扭矩與動力，齒輪具有高傳動效率與準確的傳動比大功率等優點，但是其設計與製造較為困難，不同的工業水準製造出的齒輪品質差異極大。而齒輪一般由輪齒、齒槽、端面、法面、齒頂圓、齒根圓、基圓和分度圓組成，以輪動方式分類可分為三大類兩軸平行、兩軸相交、兩軸交錯三種類型。

|		正齒輪(spur gear)	齒條與小齒輪
	兩軸平行	螺旋齒輪	針齒輪(pin gear)
		人字齒輪	
齒輪	兩軸相交	直齒斜齒輪	冠狀齒輪
		蝸線斜齒輪	
	兩軸交錯	歪斜齒輪	戟齒輪
		交叉螺旋齒輪	蝸桿與齒輪
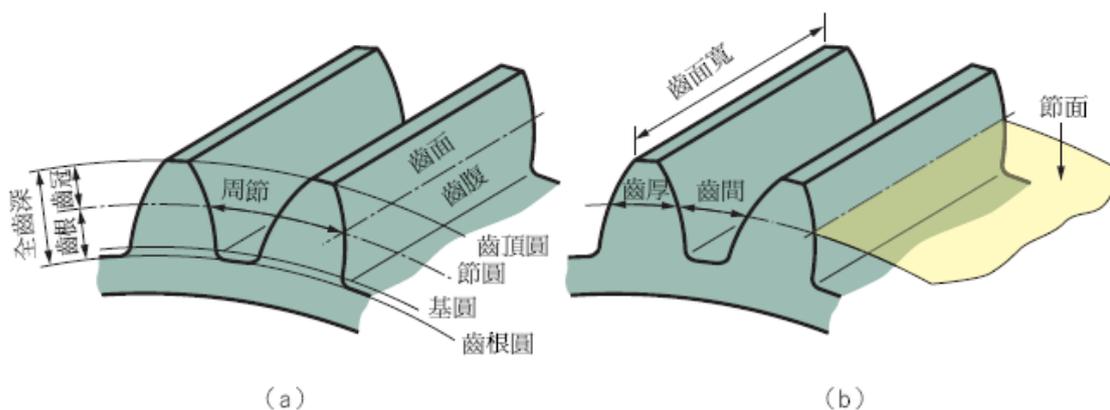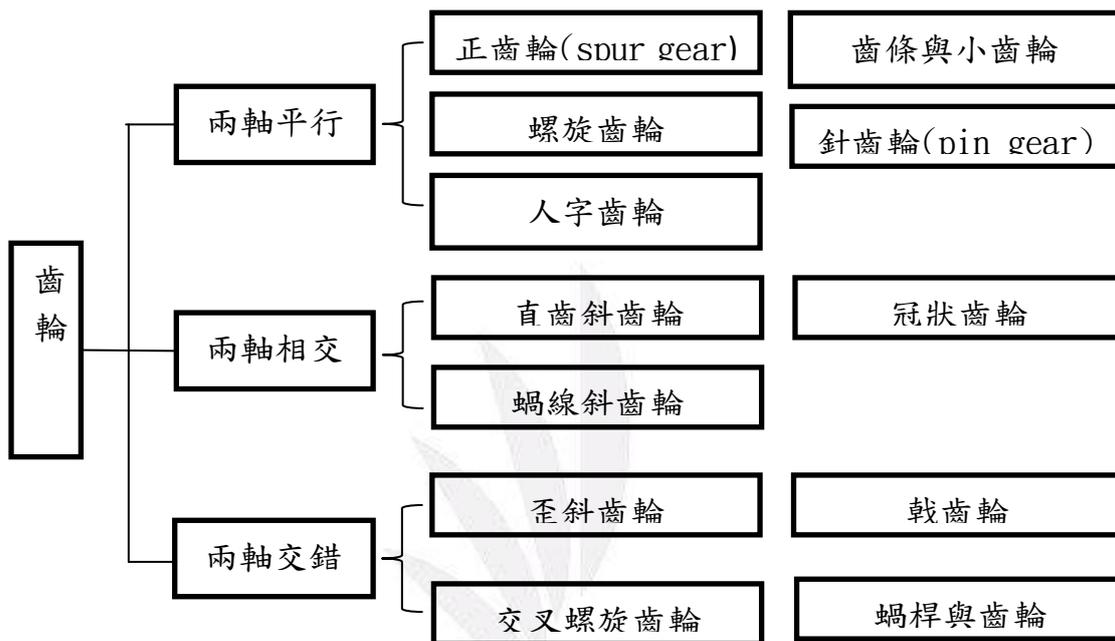
圖 1 齒輪各部位名稱[1]

三、齒輪的應用

　　齒輪傳動的應用範圍超乎我們的想像，生活周遭皆充滿著由齒輪所帶動的產品，手上所戴的手錶就是最常見的例子，利用不同齒數比的搭配讓時針秒針分針能精準地歸轉動，在路上跑的車輛則是利用齒輪來穩定傳遞由引擎所產生的動力，齒輪這個機械構件已與我們生活息息相關。

■鬧鐘
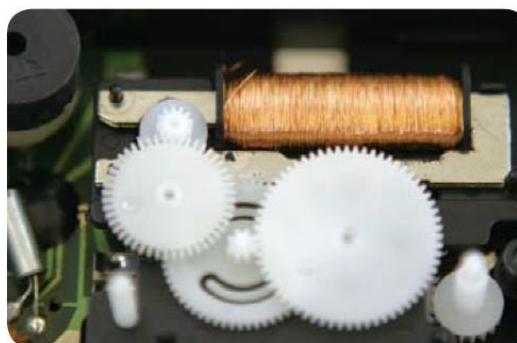
為了使指針走動使用了齒輪．拆開內部，分解出各種尺寸不同的正齒輪．

帶動長針／短針／秒針轉動的齒輪

圖 2 齒輪的應用[2]

■削鉛筆機

使用的是正齒輪和內齒輪．
正齒輪邊旋轉邊繞內齒輪做公轉，安裝在此軸上的刀具切削夾在鉛筆筒內的鉛筆．

正齒輪與內齒輪嚙合轉動刀具

圖 3 齒輪的應用[3]

四、螺旋齒輪的設計

假設

法向壓力角	$\phi_n = 25°$
假設螺旋角	$\psi = 30°$
且法向模數	$m_n = 3\ mm$
齒輪齒數	$N_p = 10$
轉速比	$VR = 7.419$

右旋齒輪

I. 橫向壓力角 ϕ

$$tan\,\phi_n = tan\,\phi\,cos\,\psi \qquad (3.1)$$

$\tan 25° = \tan\phi\cos 30°$

得橫向壓力角 $\phi = 28.3°$

II. 旋轉面模數 m

$$m = \frac{m_n}{\cos\psi} \qquad (3.2)$$

得 $m = \frac{3}{\cos 30°} = 3.464$ mm

III. 節圓直徑 d

$$d = m \times N \qquad (3.3)$$

得 $d_p = m \times N_p = 3.464 \times 10 = 34.64$ mm，取小齒輪節圓直徑 $d_p = 35$ mm

$d_g = m \times N_g = 3.464 \times 74 = 256.336$ mm，取大齒輪節圓直徑 $d_g = 260$ mm

	節圓直徑(mm)	齒數
小齒輪(輸入端)	$d_p = 35$	$N_p = 10$
大齒輪(輸出端)	$d_g = 260$	$N_g = 74$

表 1 齒輪之節圓直徑及齒數

IV. 節圓切線速度 V

$$V = \frac{\pi d_p n}{12} \qquad (3.4)$$

計算項目	記號	計算公式	$m_n = 3, \alpha_n(法向壓力角) = 25°$
跨齒數	K	$k_{th} = zK(f) + 0.5$註1 k取與k_{th}作接近的整數。	$Z(大齒輪齒數) = 74, z(小齒輪) = 10$ $\beta(螺旋角) = 30°, x_n = +0.4$
跨齒厚	W	$m_n \cos \alpha_n \{\pi(k - 0.5) + z\, inv\alpha_t\} + 2x_n m_n \sin \alpha_n$	查〔附錄一〕-漸開線函數表得 $inv28.3° = 0.043264$

註1，此時
$$K(f, \beta) = \frac{1}{\pi}\left\{\left(1 + \frac{\sin^2 \beta}{\cos^2 \beta + \tan^2 \alpha_n}\right)\sqrt{(\cos^2 \beta + \tan^2 \alpha_n)(\sec\beta + 2f)^2 - 1}\right.$$
$$\left. - inv\alpha_t - 2f \tan \alpha_n\right\}$$

得$V = \dfrac{\pi \times {}^{35}/_{25.4} \times 1150}{12} = 414.859 \ ft/min$

3-1 跨齒數及跨齒厚計算

表2 齒直角方式螺旋齒輪的跨齒數及跨齒厚

由表2及數據，求得

大齒輪之跨齒數為18，跨齒厚為7.498；

小齒輪之跨齒數為4，跨齒厚為0.499

齒輪作用力分析

如圖1所示，為螺旋齒輪齒上作用力之分析，功率傳遞沿著法向壓力線的方向，設壓力線上之作用力為F，則其三個分量分別如下：
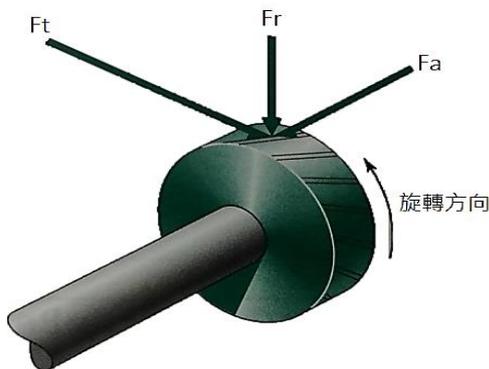
圖1 螺旋齒輪作用力分析

F_t為切線作用力，又稱為傳遞負荷或傳遞功率力，其方向為切線速度之方向。

$$F_t = \frac{33000 \times \dot{W}}{V} \quad (3.5)$$

式(3.6)中功率 $\dot{W}$ 單位是 hp，節圓速度 V 的單位是 fpm，得

$$F_t = \frac{33000 \times 5}{414.859} = 397.725 \ N$$

F_r 為徑向作用力，其方向指向軸心之方向。

$$F_r = F_t \tan \phi \quad (3.6)$$

得 $F_r = 397.725 \times \tan 28.3° = 214.153 \ N$

F_a 為軸向作用力，又稱為推力負荷。

$$F_a = F_t \tan \psi \quad (3.7)$$

$F_a = 397.725 \times \tan 30° = 229.627 \ N$

	單位:N(牛頓)
F_t	397.725
F_r	214.153
F_a	229.627

表 3 螺旋齒輪作用力分析

3-3 螺旋齒輪 AGMA 應力分析

前節為齒輪之切線作用力，對輪齒表面產生之壓力與齒根部份產生之彎曲應力關係。本節主要目的是透過求出輪齒表面之應力及材料強度之容許應力，進而決定齒面寬。

其輪齒之切線負荷 F_t，與齒根之彎曲應力 σ，及輪齒表面壓應力 σ_H 之基本方程式如下：

彎曲應力基本方程式

$$\sigma = \frac{F_t P}{b J_P} k_v k_o (0.93 k_m) \quad (3.8)$$

表面壓應力 σ_H 基本方程式

$$\sigma_H = C_p \sqrt{\frac{F_t}{b d_p I}\left(\frac{\cos \psi}{0.95 CR}\right) k_v k_o (0.93 k_m)} \quad (3.9)$$

並利用平均疲勞限應力 S'_n，依不同的使用條件加以修正，使其能反應真實狀況下之疲勞限應力 S_n，其修正結果如(3.10)式

$$S_n = S'_n C_L C_G C_S k_r k_t k_{ms} \quad (3.10)$$

以及螺旋齒輪 AGMA 強度方程式

$$S_H = S_{fe} C_{Li} C_R \quad (3.11)$$

進而決定出齒面寬 b。

式(3.8)，(3.9)中

P為旋轉面徑節

k_v為動荷重係數:

k_o為衝擊係數:

k_m為安裝修正係數:

動荷重係數k_v

動荷重係數k_v可由〔附錄二〕根據齒輪的精度及式(3.4)中標準節圓切線速度 V 求得,假設為曲線 D(滾銑成形刀),可知

$$k_v = \frac{1200+V}{1200} \quad (3.12)$$

式(3.12)中,V 的單位為ft/min,故

$$k_v = \frac{1200 + 414.859}{1200} = 1.345$$

衝擊係數k_o

由〔附錄三〕,假設其功率來源為輕度震動且被驅動機器上的負載為均勻的,可知$k_o = 1.25$

安裝修正係數k_m

由〔附錄四〕,假設其支撐的狀態為較少固定的安裝、較不準確的齒輪、接觸經過整個表面,且齒面寬介於 0 到 2,可知$k_m = 1.6$

(A)

而式(3.9)中I為

$$I = \frac{\sin\phi\cos\phi}{2}\frac{R}{R+1} \quad (3.13)$$

$$I = \frac{\sin 28.3°\cos 28.3°}{2}\frac{7.4}{7.4+1} = 0.184$$

且CR為

$$CR = \frac{\sqrt{r_{ap}^2 - r_{bp}^2} + \sqrt{r_{ag}^2 - r_{bg}^2} - c\sin\phi}{P_b} \quad (3.14)$$

$$CR = \frac{\sqrt{\left(\frac{d_p}{2}+m\right)^2 - \left(\frac{d_p}{2}\cos\phi\right)^2} + \sqrt{\left(\frac{d_g}{2}+m\right)^2 - \left(\frac{d_g}{2}\cos\phi\right)^2} - \frac{d_p+d_g}{2}\sin\phi}{\frac{\pi d_p}{N_p}\cos\phi}$$

$$= \frac{\sqrt{\left(\frac{34.64}{2} + 3.464\right)^2 - \left(\frac{34.64}{2}cos28.3°\right)^2}}{\frac{\pi \times 34.64}{10}cos28.3°}$$

$$+ \frac{\sqrt{\left(\frac{256.344}{2} + 3.464\right)^2 - \left(\frac{256.344}{2}cos28.3°\right)^2} - \frac{d_p + d_g}{2}sin\phi}{\frac{\pi \times 34.64}{10}cos28.3°} = 1.348$$

i. 　　將以上數值代回 (3.9)式，並由〔附錄五〕，假設為鋼製齒輪，可知 $C_p = 191\sqrt{MPa}$，故

$$\sigma_H = 191\sqrt{\frac{401.859}{b \times 34.64 \times 0.184} \times \frac{cos30°}{0.95 \times 1.348} \times 1.342 \times 1.25 \times (0.93 \times 1.6)} \quad (3.15)$$

ii. 　　另外，在(3.11)式 $S_H = S_{fe}C_{Li}C_R$ 中，

假設：

5 years of 40 hours/week, 50 weeks/years, 8hours/day
則 Life $= 1150 \times 60 \times 40 \times 50 \times 5 = 6.9 \times 10^8$，故壽命要求為 10^9 cycles

由〔附錄六〕，可知 $S_{fe} = 2.8 \times 330 - 69 = 855$ MPa
　〔附錄七〕，已知壽命要求為 10^9 循環，查得 $C_{Li} = 0.9$
　〔附錄八〕，假設可靠度為 99.9%，可知 $C_R = 0.80$

代回 (3.11)式，可得
$$S_H = 855 \times 0.9 \times 0.8 = 615.6 \text{ MPa} \quad (3.16)$$

iii. 　　最後，由 $\sigma_H = S_H$，即(3.15)式=(3.16)式，可得 $1933.997 \times \sqrt{\frac{1}{b}} = 615.6$，解得

　　$b = 10.257$ mm

(B)

i. 　　式(3.8)，$\sigma = \frac{F_t P}{b J_P}k_v k_o(0.93k_m)$，其中J為幾何修正係數

由〔附錄九〕中圖(a)，$\psi = 30°$、$N_p = 10$，可知 $J = 0.36$
圖(b)，$\psi = 30°$、$N_g = 74$，可知 J 乘數 $= 1$
故 $J = 0.36 \times 1 = 0.36$，

代回(3.8)式

$$\sigma = \frac{401.859 \times \frac{1}{3.464}}{b \times 0.36} \times 1.342 \times 1.25 \times (0.93 \times 1.6)$$

ii. 另外，假設齒輪的硬度為 330H_B，由(3.10)式 $S_n = S'_n C_L C_G C_S k_r k_t k_{ms}$ 其中

C_L 為疲勞應力集中係數，其為彎矩負載，取 $C_L = 1$

C_G 為尺寸係數，由〔附錄十〕，假設 $d \le 7.6$ mm，則 $C_G = 1$，其中 d 為元件之截面深，或圓直徑或元件厚度，即為特徵長度之最小值

C_S 為表面加工係數，由〔附錄十一〕，假設其為機器加工且硬度為 330 Bhn，可知

k_r 為可靠度修正係數，由〔附錄八〕，假設其可靠度為 99.9%，可 $k_r = 0.753$

k_t 為溫度修正係數，假設齒輪潤滑的溫度低於 120°C，取 $k_t =1$。

$k_{ms} = 1.4$，假設輸入及輸出端的齒輪只於單一的方向旋轉。

可得

$$S_n = (0.5 \times 0.5 \times 330 \times 6.895) \times 1 \times 1 \times 0.68 \times 0.753 \times 1 \times 1.4 = 407.77 \text{ MPa}$$

iii. 最後 $\because \sigma = S_n/n$ (假設安全係數 n=1)

$\therefore \frac{804.375}{b} = \frac{407.7}{1}$，解得 b =1.97 mm

綜合以上(A)、(B)，取齒面寬 **b = 11 mm**。

3-4 螺旋齒輪之設計

整理前節之計算，及選擇材料熱處理之方式等，本組設計的螺旋齒輪大致如下表所示：

齒輪	小齒輪 (輸入端)	大齒輪 (輸出端)
類型	JIS B 1702-1 grade N7	
參考面	法向平面	
齒形	標準全齒深齒	
模數	3	
壓力角	25°	
螺旋角	30°右旋	
齒數 N	10	74
節圓直徑 D(mm)	35	260
跨齒數	4	18
跨齒厚	0.499	7.498
齒面硬度H_B	330	
齒面寬(mm)	11	
中心距	147.5 mm	
熱處理	HRC48-52	
硬化層深	0.3-0.6	
齒輪材料	SCM440	
熱處理方式	高週波表面淬火	

表 4 螺旋齒輪之設計

五、軟體設計架構

```
                                              ┌───────┐
                                              │   1   │
                                              └───┬───┘
  ┌─────────┐                                     │
  │  開始   │                              ┌──────▼──────┐
  └────┬────┘                              │   開始計算   │
       │                                   └──────┬──────┘
  ┌────▼────────┐                                 │
  │  選擇計算類型  │                      是   ┌────▼─────┐
  └────┬────────┘                ┌──────────┤ 是否有錯  │
       │                  ┌──────▼───┐      │  誤數值   │
  ┌────▼────┐             │ 顯示警告  │◄─────┤          │
  │ 輸入參數 │◄────────────┤          │      └────┬─────┘
  └────┬────┘             └──────────┘      否    │
       │                                   ┌──────▼───────┐
  ┌────▼────────┐                          │  顯示結果及建議 │◄────┐
  │ 顯示定義及圖表 │                          └──┬────────┬──┘     │
  └────┬────────┘                   ┌──────────┘        └────┐   │
  ┌──────────┐   │                ┌─▼──────┐          ┌──────▼─┐ │
  │顯示建議訊息│   │                │ 儲存數據 │          │ 指定數據 │ │
  └────┬─────┘┌──▼─────┐          └─┬──────┘          └──────┬─┘ │
       │      │ 輸入是否 │          ┌─▼──────┐          ┌──────▼─┐ │
       │      │  合理   │          │ 寫入資料庫│          │呼叫資料庫數據│─┘
  否   │      └──┬─────┘          └────────┘          └────────┘
       └─────────┘  │是
            ┌───▼───┐
            │   1   │
            └───────┘
```
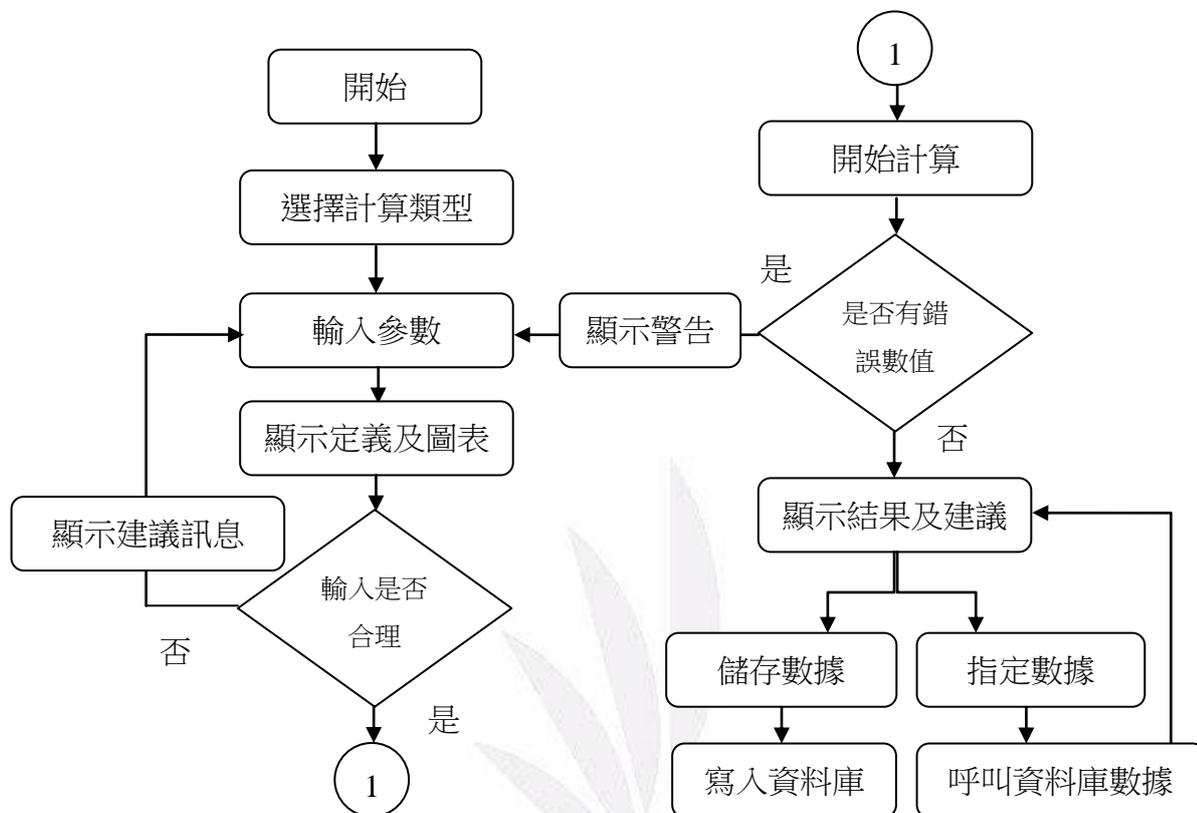
六、軟體設計介紹

　　此為軟體主要介面，依其功能不同而分成五大項，分別為：輸入區、訊息區、結果區、圖表區及功能區。
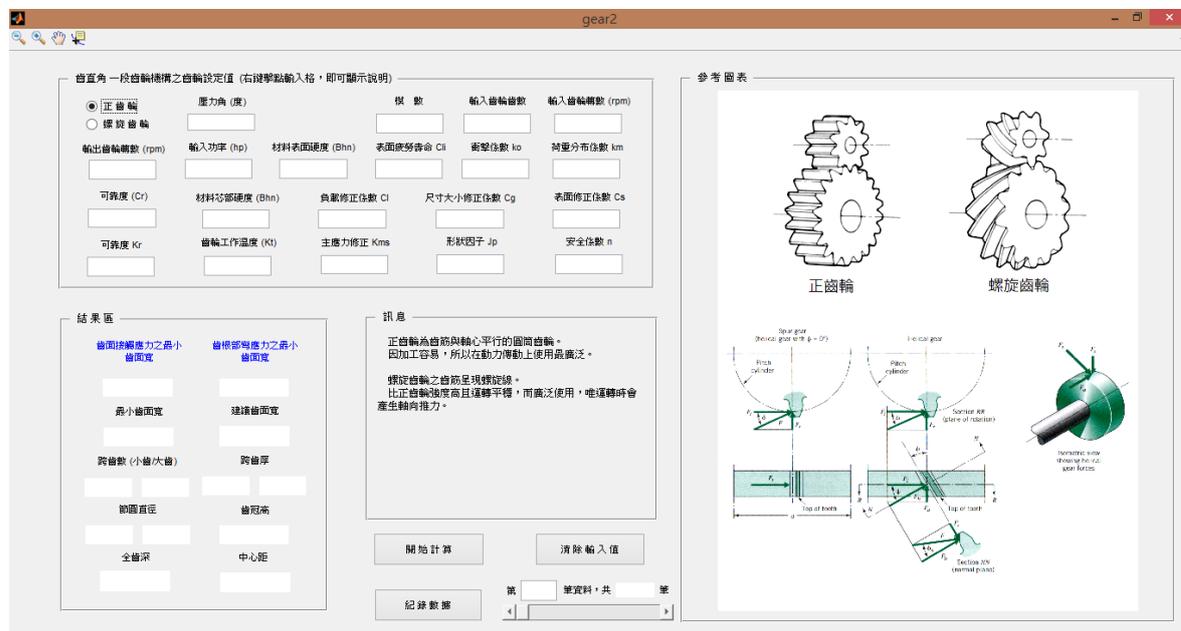
1. 輸入區

　　在此輸入齒輪基本參數，目前有正齒輪、螺旋齒輪兩種計算模式，在選擇模式時，右方參數輸入格，只會顯示需要之參數，不必要之參數則會隱藏（例：正齒輪不須螺旋角），避免不需要的困擾。

　　在輸入參數時，正確之輸入值會呈現黑色，錯誤之輸入值則會呈現紅色（如圖）。

2. 結果區

　　結果區會顯示目前之設定值所計算後的結果，會比較齒面接觸應力及齒根部彎應力所求出之兩齒面寬，算出適當之齒面寬數值，且會依一般常見之齒面寬設計值，給出建議齒面寬值。

　　程式同時也會計算出目前設定之齒輪基本參數，如跨齒數、跨齒厚、節圓直徑、中心距等等，這些參數可作為齒輪加工依據。

3. 圖表區
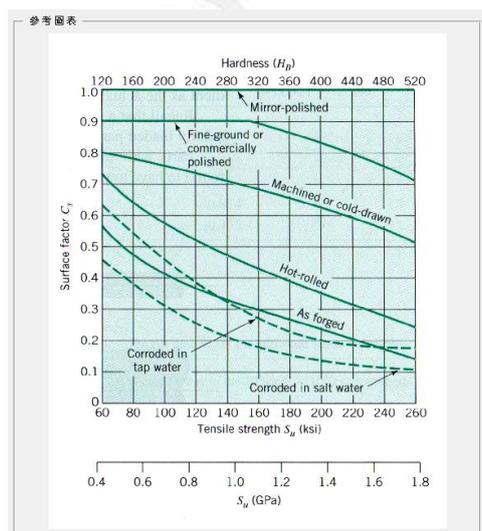
　　在輸入區輸入齒輪基本參數時，圖表區會顯示相對應之參考圖表，如壓力角之定義、各修正係數之圖表等等，方便使用者可以直接查詢，不用翻閱大量資料，以節省時間。

查閱圖表時，可利用視窗左上角之圖表工具 ，自由縮放、拖拉或標註記號點，方便使用者查看圖表。

4. 訊息區
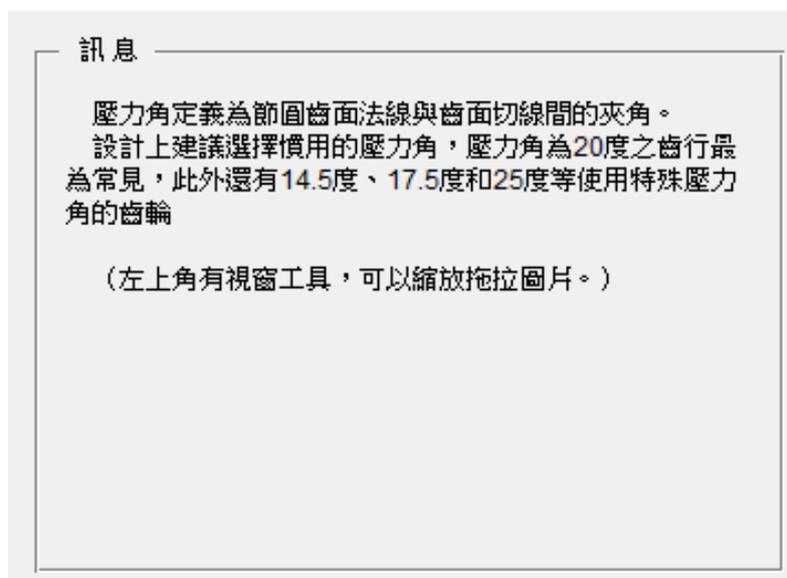
訊息區會顯示重要提示訊息。輸入設定值時，訊息區會顯示此設定值之定義，方便使用者釐清數值（上圖），或是數值值呈現紅色錯誤時，訊息區會顯示錯誤原因及建議數值。（下圖）

5. 功能區
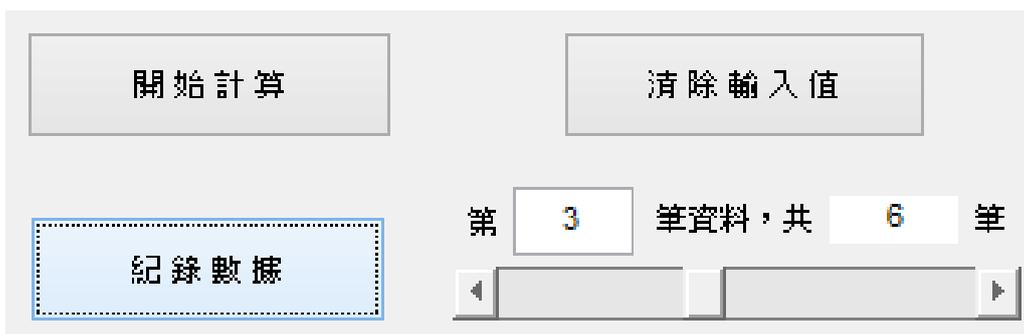
程式計算及分析功能主要集中於功能區。

　　輸入完基本設定值後，按下開始計算，即可計算齒輪數值。若有設定值錯誤則會調出彈出視窗，告知使用者（下圖）。清除輸入值則是能一次清除所有設定值，方便使用者做大量修改之用。

　　計算完成後按下紀錄數據，程式會記錄所有計算模式、設定值及計算值，並顯示目前記錄了幾筆資料。使用者只要拉動滑條，程式就會立即呼叫資料庫中相對應之紀錄值，可以利用此功能快速且大量比較不同之設定值，從中選出適當之齒輪設定值。

七、軟體應用

　　介面將基本設定值整齊排列，同時訊息區會顯示各種提示及建議，使用者可依序輸入、不易混淆。進行齒輪設計時往往要查閱大量圖表，此程式將其整合並以動態方式呈現於圖表區，再配合圖表工具，省力又省時。結果區除了理論值外，亦有習慣設計之建議值，同時也將齒輪基本參數呈現，加上數據紀錄能快速比較設定值及結果，大大方便使用者設計及評估。

　　未來再加入齒條、傘齒輪等多種計算模式、數據封包輸出、齒輪繪圖等，程式可更加全面的應用。

八、結論:

當我們每次要設計一組齒輪就要重複的計算一組新的數據，因此我們決定要設計一個輔助程式，來幫我們做這些複雜的計算過程，並且每組數據都可以做紀錄比較，所以我們選用了 Matlab 的軟體來輔助設計，這樣大大的提升了我們的效率，所以我們就不需要再因為一個小小的變化導致我們要重新計算，所以我們一開始在做手算的時候所假設數據都是比較簡單而且容易計算的，因為我們只是要瞭解

在計算齒輪得過程寫完了這個程式後我們對與這個計算軟體的設計有些許的進步，在外來我們如果課業上在碰到這種複雜難計算的設計，希望也都能夠透過 matlab 來解決問題。很幸運的是我們這學期剛好有修機械設計和 matlab，然後我們就把這兩個課程結合在一起，這樣做起事來事半功倍。
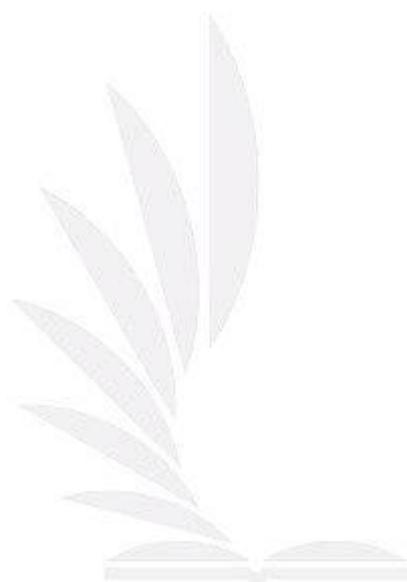
七、引注資料

[1] 龍騰文化,"第九章齒輪介紹", http://www.lungteng.com.tw/
[2] 小原齒車工業珠式會社,"KHK 齒輪 ABC 入門篇",http://www.khkgears.co.jp/
[3] 小原齒車工業珠式會社,"KHK 齒輪 ABC 入門篇",http://www.khkgears.co.jp/

附錄

–漸開線函數表

漸開線函數表

$\text{inv}\,\alpha = \tan \alpha - \alpha$

分(')	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°
0	0.020054	0.023049	0.026350	0.029975	0.033947	0.038287	0.043017	0.048164	0.053751	0.059809
1	0.020101	0.023102	0.026407	0.030039	0.034016	0.038362	0.043100	0.048253	0.053849	0.059914
2	0.020149	0.023154	0.026465	0.030102	0.034086	0.038438	0.043182	0.048343	0.053946	0.060019
3	0.020197	0.023207	0.026523	0.030166	0.034155	0.038514	0.043264	0.048432	0.054043	0.060124
4	0.020244	0.023259	0.026581	0.030229	0.034225	0.038589	0.043347	0.048522	0.054140	0.060230
5	0.020292	0.023312	0.026639	0.030293	0.034294	0.038666	0.043430	0.048612	0.054238	0.060335
6	0.020340	0.023365	0.026697	0.030357	0.034364	0.038742	0.043513	0.048702	0.054336	0.060441
7	0.020388	0.023418	0.026756	0.030420	0.034434	0.038818	0.043596	0.048792	0.054433	0.060547
8	0.020436	0.023471	0.026814	0.030484	0.034504	0.038894	0.043679	0.048883	0.054531	0.060653
9	0.020484	0.023524	0.026872	0.030549	0.034574	0.038971	0.043762	0.048973	0.054629	0.060759
10	0.020533	0.023577	0.026931	0.030613	0.034644	0.039047	0.043845	0.049063	0.054728	0.060866
11	0.020581	0.023631	0.026989	0.030677	0.034714	0.039124	0.043929	0.049154	0.054826	0.060972
12	0.020629	0.023684	0.027048	0.030741	0.034785	0.039201	0.044012	0.049245	0.054924	0.061079
13	0.020678	0.023738	0.027107	0.030806	0.034855	0.039278	0.044096	0.049336	0.055023	0.061186
14	0.020726	0.023791	0.027166	0.030870	0.034926	0.039355	0.044180	0.049427	0.055122	0.061292
15	0.020775	0.023845	0.027225	0.030935	0.034996	0.039432	0.044264	0.049518	0.055221	0.061400
16	0.020824	0.023899	0.027284	0.031000	0.035067	0.039509	0.044348	0.049609	0.055320	0.061507
17	0.020873	0.023952	0.027343	0.031065	0.035138	0.039586	0.044432	0.049701	0.055419	0.061614
18	0.020921	0.024006	0.027402	0.031130	0.035209	0.039664	0.044516	0.049792	0.055518	0.061721
19	0.020970	0.024060	0.027462	0.031195	0.035280	0.039741	0.044601	0.049884	0.055617	0.061829
20	0.021019	0.024114	0.027521	0.031260	0.035352	0.039819	0.044685	0.049976	0.055717	0.061937
21	0.021069	0.024169	0.027581	0.031325	0.035423	0.039897	0.044770	0.050068	0.055817	0.062045
22	0.021118	0.024223	0.027640	0.031390	0.035494	0.039974	0.044855	0.050160	0.055916	0.062153
23	0.021167	0.024277	0.027700	0.031456	0.035566	0.040052	0.044939	0.050252	0.056016	0.062261
24	0.021217	0.024332	0.027760	0.031521	0.035637	0.040131	0.045024	0.050344	0.056116	0.062369
25	0.021266	0.024386	0.027820	0.031587	0.035709	0.040209	0.045110	0.050437	0.056217	0.062478
26	0.021316	0.024441	0.027880	0.031653	0.035781	0.040287	0.045195	0.050529	0.056317	0.062586
27	0.021365	0.024495	0.027940	0.031718	0.035853	0.040366	0.045280	0.050622	0.056417	0.062695
28	0.021415	0.024550	0.028000	0.031784	0.035925	0.040444	0.045366	0.050715	0.056518	0.062804
29	0.021465	0.024605	0.028060	0.031850	0.035997	0.040523	0.045451	0.050808	0.056619	0.062913
30	0.021514	0.024660	0.028121	0.031917	0.036069	0.040602	0.045537	0.050901	0.056720	0.063022
31	0.021564	0.024715	0.028181	0.031983	0.036142	0.040680	0.045623	0.050994	0.056821	0.063131
32	0.021614	0.024770	0.028242	0.032049	0.036214	0.040759	0.045709	0.051087	0.056922	0.063241
33	0.021665	0.024825	0.028302	0.032116	0.036287	0.040838	0.045795	0.051181	0.057023	0.063350
34	0.021715	0.024881	0.028363	0.032182	0.036359	0.040918	0.045881	0.051274	0.057124	0.063460
35	0.021765	0.024936	0.028424	0.032249	0.036432	0.040997	0.045967	0.051368	0.057226	0.063570
36	0.021815	0.024992	0.028485	0.032315	0.036505	0.041076	0.046054	0.051462	0.057328	0.063680
37	0.021866	0.025047	0.028546	0.032382	0.036578	0.041156	0.046140	0.051556	0.057429	0.063790
38	0.021916	0.025103	0.028607	0.032449	0.036651	0.041236	0.046227	0.051650	0.057531	0.063901
39	0.021967	0.025159	0.028668	0.032516	0.036724	0.041316	0.046313	0.051744	0.057633	0.064011
40	0.022018	0.025214	0.028729	0.032583	0.036798	0.041395	0.046400	0.051838	0.057736	0.064122
41	0.022068	0.025270	0.028791	0.032651	0.036871	0.041475	0.046487	0.051933	0.057838	0.064232
42	0.022119	0.025326	0.028852	0.032718	0.036945	0.041556	0.046575	0.052027	0.057940	0.064343
43	0.022170	0.025382	0.028914	0.032785	0.037018	0.041636	0.046662	0.052122	0.058043	0.064454
44	0.022221	0.025439	0.028976	0.032853	0.037092	0.041716	0.046749	0.052217	0.058146	0.064565
45	0.022272	0.025495	0.029037	0.032920	0.037166	0.041797	0.046837	0.052312	0.058249	0.064677
46	0.022324	0.025551	0.029099	0.032988	0.037240	0.041877	0.046924	0.052407	0.058352	0.064788
47	0.022375	0.025608	0.029161	0.033056	0.037314	0.041958	0.047012	0.052502	0.058455	0.064900
48	0.022426	0.025664	0.029223	0.033124	0.037388	0.042039	0.047100	0.052597	0.058558	0.065012
49	0.022478	0.025721	0.029285	0.033192	0.037462	0.042120	0.047188	0.052693	0.058662	0.065123
50	0.022529	0.025778	0.029348	0.033260	0.037537	0.042201	0.047276	0.052788	0.058765	0.065236
51	0.022581	0.025834	0.029410	0.033328	0.037611	0.042282	0.047364	0.052884	0.058869	0.065348
52	0.022632	0.025891	0.029472	0.033397	0.037686	0.042363	0.047452	0.052980	0.058973	0.065460
53	0.022684	0.025948	0.029535	0.033465	0.037761	0.042444	0.047541	0.053076	0.059077	0.065573
54	0.022736	0.026005	0.029598	0.033534	0.037835	0.042526	0.047630	0.053172	0.059181	0.065685
55	0.022788	0.026062	0.029660	0.033602	0.037910	0.042607	0.047718	0.053268	0.059285	0.065798
56	0.022840	0.026120	0.029723	0.033671	0.037985	0.042689	0.047807	0.053365	0.059390	0.065911
57	0.022892	0.026177	0.029786	0.033740	0.038060	0.042771	0.047896	0.053461	0.059494	0.066024
58	0.022944	0.026235	0.029849	0.033809	0.038136	0.042853	0.047985	0.053558	0.059599	0.066137
59	0.022997	0.026292	0.029912	0.033878	0.038211	0.042935	0.048074	0.053655	0.059704	0.066250
60	0.023049	0.026350	0.029975	0.033947	0.038287	0.043017	0.048164	0.053751	0.059809	0.066364

-動荷重係數k_v
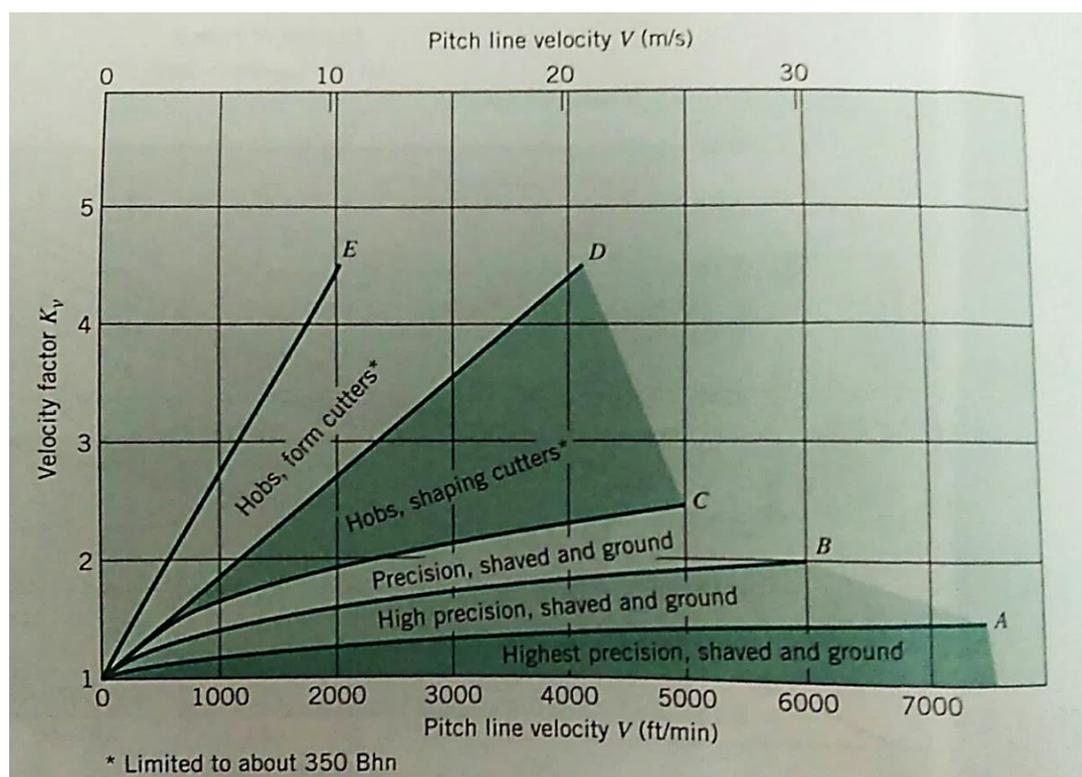
FIGURE 15.24

Velocity factor K_v. (Note: This figure, in a very rough way, is intended to account for the effects of tooth spacing and profile errors, tooth stiffness, and the velocity, inertia, and stiffness of the rotating parts.)

$$A: \quad K_v = \sqrt{\frac{78 + \sqrt{V}}{78}}$$

$$D: \quad K_v = \frac{1200 + V}{1200}$$

$$B: \quad K_v = \frac{78 + \sqrt{V}}{78}$$

$$E: \quad K_v = \frac{600 + V}{600}$$

$$C: \quad K_v = \frac{50 + \sqrt{V}}{50}$$

Note: V is in feet per minute.

-衝擊係數 k_o

表3.8　衝擊係數 K_o 的大小

被動機械		驅動原動機		
負荷	種類	均一負荷 （電動機 油壓馬達）	輕度衝擊 （渦輪機 多缸引擎）	中度衝擊 （單缸引擎）
衝擊小	送風機、升降機、押出機、輸送機（均一負荷）、水處理機械（輕負荷）、釀造蒸餾裝置、發電機等。	1.0	1.25	1.5
衝擊中	攪拌機、車輛、選別機、天車、供料機、壓縮機、食品機械、工作母機、製紙機械、纖維機械等。	1.25	1.5	2.0
衝擊大	破碎機、錘碎機、軋延機、鍛造機、製材機械、窯業機械（重負荷）、供料機（往復式）、翻轉器等。	1.75	2.0	2.25

-安裝修正係數 k_m

TABLE 15.2　Mounting Correction Factor K_m

Characteristics of Support	Face Width (in.)			
	0 to 2	6	9	16 up
Accurate mountings, small bearing clearances, minimum deflection, precision gears	1.3	1.4	1.5	1.8
Less rigid mountings, less accurate gears, contact across the full face	1.6	1.7	1.8	2.2
Accuracy and mounting such that less than full-face contact exists		Over 2.2		

-C_p

Table 15.4a Values of Elastic Coefficient C_p for Spur Gears, in $\sqrt{psi}$
(Values Rounded Off)

Pinion Material ($\nu = 0.30$ in All Cases)	Gear Material			
	Steel	Cast Iron	Aluminum Bronze	Tin Bronze
Steel, $E = 30{,}000$ ksi	2300	2000	1950	1900
Cast iron, $E = 19{,}000$ ksi	2000	1800	1800	1750
Aluminum bronze, $E = 17{,}500$ ksi	1950	1800	1750	1700
Tin bronze, $E = 16{,}000$ ksi	1900	1750	1700	1650

Table 15.4b Values of Elastic Coefficient C_p for Spur Gears, in $\sqrt{MPa}$
(Values Converted from Table 15.4a)

Pinion Material ($\nu = 0.30$ in All Cases)	Gear Material			
	Steel	Cast Iron	Aluminum Bronze	Tin Bronze
Steel, $E = 207$ GPa	191	166	162	158
Cast iron, $E = 131$ GPa	166	149	149	145
Aluminum bronze, $E = 121$ GPa	162	149	145	141
Tin bronze, $E = 110$ GPa	158	145	141	137

-S_{fe}

TABLE 15.5 Surface Fatigue Strength S_{fe}, for Use with Metallic Spur Gears
(10⁷-Cycle Life, 99 Percent Reliability, Temperature <250°F)

Material	S_{fe} (ksi)	S_{fe} (MPa)
Steel	0.4 (Bhn)–10 ksi	28 (Bhn)–69 MPA
Nodular iron	0.95[0.4 (Bhn)–10 ksi]	0.95[28 (Bhn)–69 MPa]
Cast iron, grade 20	55	379
grade 30	70	482
grade 40	80	551
Tin bronze AGMA 2C (11 percent tin)	30	207
Aluminum bronze (ASTM B 148—52) (Alloy 9C—H.T.)	65	448

-C_{Li}

FIGURE 15.27
Values of C_{Li} for steel gears (general shape of surface fatigue S–N curve).

齒輪輔助程式設計
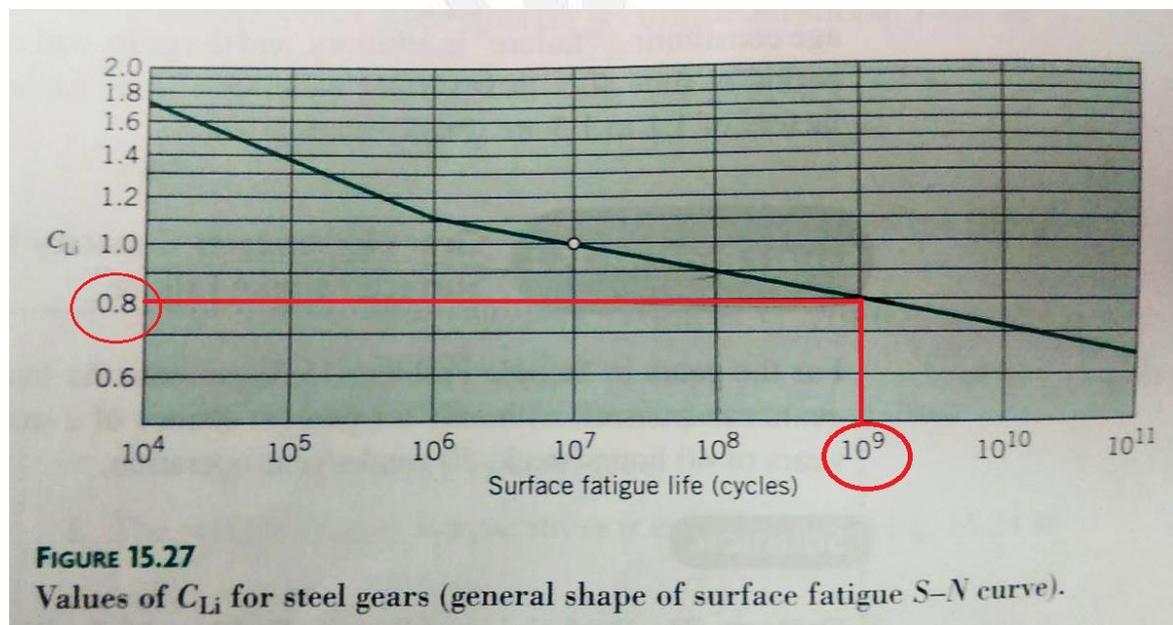
-k_r、C_R

TABLE 15.3 Reliability Correction Factor k_r, from Figure 6.19 with Assumed Standard Deviation of 8 Percent

| Reliability (%)	50	90	99	99.9	99.99	99.999
Factor k_r	1.000	0.897	0.814	0.753	0.702	0.659

TABLE 15.6 Reliability Factor C_R

Reliability (%)	C_R
50	1.25
99	1.00
99.9	0.80

		Bending	Axial	Torsion
C_L	(load factor)	1.0	1.0	0.58
C_G	(gradient factor):	1.0	0.7 to 0.9	1.0
	diameter < (0.4 in. or 10 mm)			
	(0.4 in. or 10 mm) < diameter < (2 in. or 50 mm)[c]	0.9	0.7 to 0.9	0.9
C_S	(surface factor)	see 附錄十一		
C_T	(temperature factor)	Values are only for steel		
	T ≤ 840 °F	1.0	1.0	1.0
	840 °F < T ≤ 1020 °F	1 - (0.0032T - 2.688)		
C_R	(reliability factor):[d]			
	50% reliability	1.000	"	"
	90% "	0.897	"	"

-幾何修正係數

FIGURE 16.8

For helical gears having $\phi_n = 20°$, standard addendum of $1/P_n$, and shaved teeth: (a) geometry factor J for use with a 75-tooth mating gear (spur gear values from Figure 15.23 are shown at $\psi = 0°$ for comparison); (b) the J-factor multipliers for use when the mating gear has other than 75 teeth. (From AGMA Information Sheet 226.01, which also gives J factors for $\phi_n = 14.5°$, 15°, and 20°, for unequal gear and pinion addendum, and for ground- and hobbed-tooth surfaces; also see AGMA 908-B89.)

J

-尺寸係數C_G(即下圖之k_b)

尺寸修正係數k_b如下所示：

$k_b = 1.0$，當$d \leq 7.6$ mm

$k_b = 0.84$，當$7.6 < d \leq 51$ mm

$k_b = 0.74$，當$d > 51$ mm

其中，d為元件之截面半徑或口直徑或元件厚度，即為特徵長度之最小值。

-表面加工係數C_S
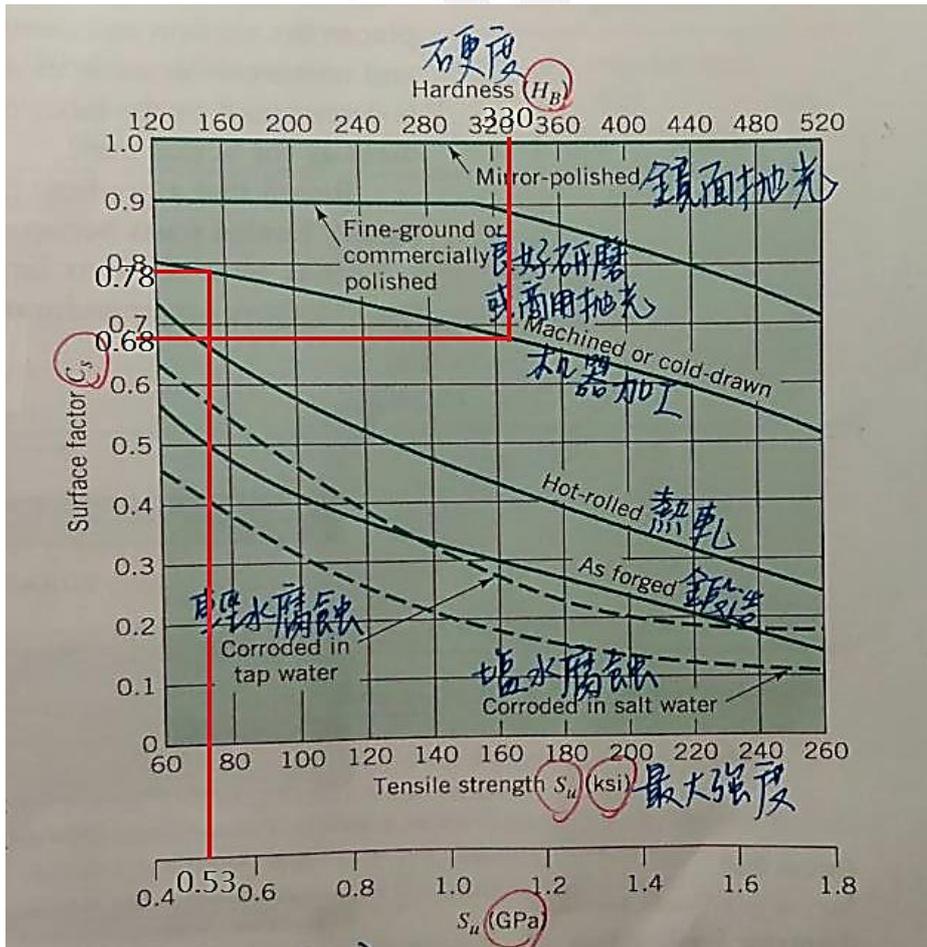
附錄

「逢甲大學第一屆精密機械專題暨應用競賽」銀牌獎獎狀

逢甲大學工學院獎狀

林昰辰、吳宗叡、陳柏叡

榮獲「逢甲大學第一屆

精密機械專題暨應用競賽」

程式設計組銀牌獎

特頒此狀，以資獎勵

院長 黃錦煌

中華民國 104 年 6 月 17 日

附錄
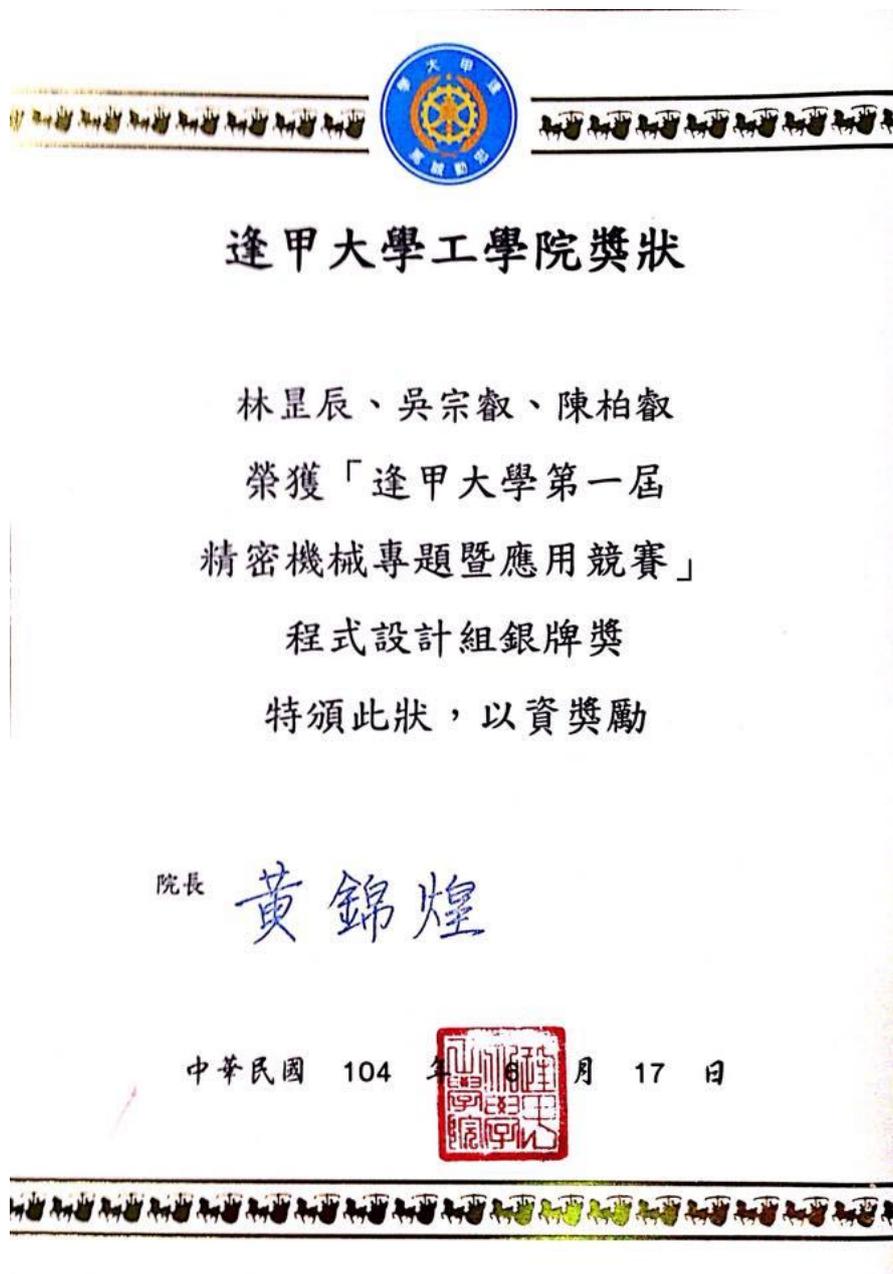
程式碼全文

```matlab
function varargout = gear2(varargin)
% GEAR2 MATLAB code for gear2.fig
%      GEAR2, by itself, creates a new GEAR2 or raises the existing
%      singleton*.
%
%      H = GEAR2 returns the handle to a new GEAR2 or the handle to
%      the existing singleton*.
%
%      GEAR2('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in GEAR2.M with the given input arguments.
%
%      GEAR2('Property','Value',...) creates a new GEAR2 or raises the
%      existing singleton*.  Starting from the left, property value pairs
are
%      applied to the GUI before gear2_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property
application
%      stop.  All inputs are passed to gear2_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only
one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help gear2

% Last Modified by GUIDE v2.5 04-Jun-2015 13:11:27

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @gear2_OpeningFcn, ...
                   'gui_OutputFcn',  @gear2_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
```

```matlab
                    'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end


if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT



% --- Executes just before gear2 is made visible.
function gear2_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to gear2 (see VARARGIN)


% Choose default command line output for gear2
handles.output = hObject;


% Update handles structure
guidata(hObject, handles);


% UIWAIT makes gear2 wait for user response (see UIRESUME)
% uiwait(handles.figure1);



% --- Outputs from this function are returned to the command line.
function varargout = gear2_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```matlab
% Get default command line output from handles structure
varargout{1} = handles.output;



% --- Executes during object creation, after setting all properties.
function type1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to type1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called



% --- Executes during object creation, after setting all properties.
function type2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to type2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called
global type;  %-p°â¼Ò¦¡
type=2;


% --- Executes on button press in type1.
function type1_Callback(hObject, eventdata, handles)
% hObject    handle to type1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of type1
global type
type=1;
set(handles.type2,'Value',0)
set(handles.type1,'Value',1)
set(handles.text1,'string','À£¤O¨¤ («×)')
set(handles.text2,'Visible','off')
set(handles.edit2,'Visible','off')

set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¥¿¾¦½ü¬°¾¦µ¬»P¶b¤ß¥-¦æª°¶êµ©¾¦½ü¡C','
¡@¦¦]¥[¤u®e©ö¡A©Ò¥H¦b°Ê¤O¶Ç°Ê¤W¨Ï¥Î³Ì¼sª×¡C'...
     ,'','¡@Á³±Û¾¦½ü¤§¾¦µ¬§e²Á³±Û½u¡C','¡@¤ñ¥¿¾¦½ü±j«×°ª¥B¹BÂà¥Ã-¡A¦Ó¼
```

齒輪輔助程式設計

```
sªx¨Ï¥Î¡A°ß¹BÂà®É·|²£¥Í¶b¦V±À¤O¡C'});  % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\gear.jpg');


% --- Executes on button press in type2.
function type2_Callback(hObject, eventdata, handles)
% hObject    handle to type2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of type2
global type
type=2;
set(handles.type1,'Value',0)
set(handles.type2,'Value',1)
set(handles.text1,'string','¾î¦VÀ£¤O¨¤  («×)')
set(handles.text2,'Visible','on')
set(handles.edit2,'Visible','on')

set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¥¿¾¦½ü¬°¾¦µ¬»P¶b¤ß¥-¦æª°¶êµ©¾¦½ü¡C','
¡@¦]¥[¤u®e©ö¡A©Ò¥H¦b°Ê¤O¶Ç°Ê¤W¨Ï¥Î³Ì¼sªªx¡C'...
   ,'','¡@Á³±Û¾¦½ü¤§¾¦µ¬§e²Á³±Û½u¡C','¡@¤ñ¥¿¾¦½ü±j«×°ª¥B¹BÂà¥-Ã-¡A¦Ó¼
sªx¨Ï¥Î¡A°ß¹BÂà®É·|²£¥Í¶b¦V±À¤O¡C'});  % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\gear.jpg');


function edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit1 as text
%        str2double(get(hObject,'String')) returns contents of edit1 as
a double
global error
input1 = str2num(get(hObject,'String')); %
```

齒輪輔助程式設計

ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^

```matlab
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input1))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(1)=1;
elseif input1==0
    set(handles.text17,'String','À£¤O¨¤§¨¤«×¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(1)=1;
elseif input1>=90
    set(handles.text17,'String','À£¤O¨¤§¨¤«×¤£¥i¶W¹L90«×');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(1)=1;
else
    set(handles.text17,'string','');
    error(1)=0;
end
guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit1.
function edit1_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
global type
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@À£¤O¨¤©w¸q¬°¸`¶ê¾¦-±ªk½u»P¾¦-±Á½u¶¡ª
°§¨¨¤¡C','¡@³]-p¤W«ØÄ³¿ï¾Ü°D¥Îª°À£¤O¨¤¡AÀ£¤O¨¤¬°20«×¤§¾¦¦æ³Ì¬°±`¨£¡A¦
¹¥~ÁÙ¦³14.5«×¡B17.5«×©M25«×µ¥¨Ï¥Î¯S®íÀ£¤O¨¤ª°¾¦½ü'...
    ,'','¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁ¥©ñ©ì©Ô¹Ï¤ù¡C¡^'});  %
Åã¥Üµù¸Ñ©Î»¡©ú


if type==1
    imshow('.\Picture\gear2.jpg');
```

```matlab
elseif type==2
    imshow('.\Picture\figure 16.4.jpg');
else
end


guidata(hObject, handles);



% --- Executes during object creation, after setting all properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit2_Callback(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit2 as text
%        str2double(get(hObject,'String')) returns contents of edit2 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
```

```matlab
    error(2)=1;
elseif input2==0
    set(handles.text17,'String','Á³±Û¨¤¤§¨¤«×¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(2)=1;
elseif input2>=90
    set(handles.text17,'String','Á³±Û¨¤¤§¨¤«×¤£¥i¶W¹L90«×');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(2)=1;
else
    set(handles.text17,'string','');
    error(2)=0;
end
guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit2_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡
C¡^'});  % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\figure 16.4.jpg');


% --- Executes during object creation, after setting all properties.
function edit2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
```

```matlab
    set(hObject,'BackgroundColor','white');
end




function edit3_Callback(hObject, eventdata, handles)
% hObject    handle to edit3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit3 as text
%        str2double(get(hObject,'String')) returns contents of edit3 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(3)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(3)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(3)=1;
else
    set(handles.text17,'string','');
    error(3)=0;
end


guidata(hObject, handles);
```

```matlab
% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit3_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¼Ò¼Æ¤j¤p¥Nªí¾¦½üª°¾¦§Î¤j¤p¡A¦P®É¤]·|¼
vÅT¤M¨ã¤j¤p¡C',...

'¡@¾¦½ü¬O¶ê§Î¡A³]-p¥H¶ê©Pªø¤À§G¾¦¼Æ¡A©Ò¥H¤½¨î¼Ò¼Æ*¶ê©P²v(£k)=¸`¶Z(¾¦¶
Z)¡C',...

'¡@·í¼Ò¼Æmp2¡Aª½®|¨C2mm¼W¥[1¾¦¡A´«¨¥¤§¡Amp2¸`¶Z´N¬O3.14(£k*mp2)=6.28'
,'','¡@¡]¥ª¤W¨¤¡³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla
```

```matlab
% --- Executes during object creation, after setting all properties.
function edit3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

```matlab
function edit4_Callback(hObject, eventdata, handles)
% hObject    handle to edit4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit4 as text
```

```matlab
%       str2double(get(hObject,'String')) returns contents of edit4 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])


a=str2num(get(handles.edit1,'String'));
nmin=round(2/(sind(a))/(sind(a)));


if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(4)=1;
elseif rem(input2,1)
    set(handles.text17,'String','¼Æ-È¥²¶·¬°¾ã¼Æ');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(4)=1;
elseif input2<nmin

text=['À£¤O¨¤¬°',num2str(a),'«×®É¡A¾¦¼Æ»Ý¤j©ó',num2str(nmin-1),'¾¦'];
    set(handles.text17,'String',text);
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(4)=1;
else
   set(handles.text17,'string','');
   error(4)=0;
end
guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit4_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```matlab
a=str2num(get(handles.edit1,'String'));
nmin=round(2./(sind(a))/(sind(a)));
set(handles.text17,'ForegroundColor',[0,0,0])
text=['¡@À£¤O¨¤¬°',num2str(a),'«×®É¡A¾¦¼Æ»Ý¤j©ó',num2str(nmin-1),'¾¦'
];
set(handles.text17,'string',{'¡@¾¦¼Æ¹L¤Ö®É¡A¥[¤u¹Lµ¤¤¾¦½ü®Ú³¡ª°°¥¶½u¾
¦¹ø±N³Q¤Á¥h¤@³¡¤À¡A³o°Ø²¶H°Ù¬°®Ú¤Á¡C',...
    '¡@¦Ó³Ì¤p¾¦¼Æ©MÀ£¤O¨¤a¦³Ãö¡A¨äÃö«Y¦¡¬°2/(sin(a)/(sin(a)','',text});
% Åã¥Üµù¸Ñ©Î»¡©ú
cla




% --- Executes during object creation, after setting all properties.
function edit4_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit5_Callback(hObject, eventdata, handles)
% hObject    handle to edit5 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit5 as text
%        str2double(get(hObject,'String')) returns contents of edit5 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤¥Î¡]string¹w³]¬°¦r¡ê¡A-nÂà´«¬°¼Æ-È¡^
```

```matlab
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(5)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(5)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(5)=1;
else
    set(handles.text17,'string','');
    error(5)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit5_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{''});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla


% --- Executes during object creation, after setting all properties.
function edit5_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit5 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called
```

齒輪輔助程式設計

```matlab
% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit6_Callback(hObject, eventdata, handles)
% hObject    handle to edit6 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit6 as text
%        str2double(get(hObject,'String')) returns contents of edit6 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(6)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(6)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(6)=1;
else
    set(handles.text17,'string','');
    error(6)=0;
```

```
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit6_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{''});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla



% --- Executes during object creation, after setting all properties.
function edit6_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit6 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit7_Callback(hObject, eventdata, handles)
% hObject    handle to edit7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit7 as text
%        str2double(get(hObject,'String')) returns contents of edit7 as
a double
```

齒輪輔助程式設計

```matlab
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(7)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(7)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(7)=1;
else
    set(handles.text17,'string','');
    error(7)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit7_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{''});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla


% --- Executes during object creation, after setting all properties.
function edit7_CreateFcn(hObject, eventdata, handles)
```

```matlab
% hObject    handle to edit7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit8_Callback(hObject, eventdata, handles)
% hObject    handle to edit8 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit8 as text
%        str2double(get(hObject,'String')) returns contents of edit8 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(8)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(8)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
```

```matlab
    error(8)=1;
else
    set(handles.text17,'string','');
    error(8)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit8_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@ªí-±µw«×¬O«üª«Åéªí-±©è§ÜÅÜ§Î©Î·l¶Ëªº¯
à¤O¡C',});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla


% --- Executes during object creation, after setting all properties.
function edit8_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit8 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function edit9_Callback(hObject, eventdata, handles)
% hObject    handle to edit9 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```matlab
% handles   structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit9 as text
%        str2double(get(hObject,'String')) returns contents of edit9 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(9)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(9)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(9)=1;
else
    set(handles.text17,'string','');
    error(9)=0;
end

guidata(hObject, handles);

% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit9_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¯h³Ò·l¶Ëµo¥Í¦b¨ü¥æ¤¬À³¤O§@¥Îª°¹s¥ó©M°
```

齒輪輔助程式設計

```
c¥ó¡C',...

'¡@¹s¥ó¦b§C©ó§÷®Æ©ªA·¥--ª°¥æÅÜÀ³¤O¤§§@¥Î¤ÏÂÐ¤U¡A¸g¤@©wª°´`Àô
¦¸¼Æ«á¡A¦bÀ³¤O¶°¤¤³¡¦ìµÞ¥Íµõ¯¾¡C',...

'¡@µõ¯¾¦b¤@©w±ø¥ó¤U«ùÄòÂX®i¡A¥H-P³Ì²×Â_µõ¡C','','¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã
¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});  % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\figure 15.27.jpg');


% --- Executes during object creation, after setting all properties.
function edit9_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit9 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function edit10_Callback(hObject, eventdata, handles)
% hObject    handle to edit10 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit10 as text
%        str2double(get(hObject,'String')) returns contents of edit10 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
```

```matlab
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(10)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(10)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(10)=1;
else
    set(handles.text17,'string','');
    error(10)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit10_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@½ÄÀ»«Y¼Æ
ko¥Î©ó-×¥¿¾÷±ñ°Ê¤O¿é¥X³y¦¨ª°½ÄÀ»¹ï©ó¾¦³¡À³¤Oª°¼vÅT¡A®Ú¾Ú¿é¤J»P¿é¥X¾÷¾
¹°ØÃþ¨ã¦³¤£¦Pª°-t²ü«Y¼Æ¡C','',...
    '','','¡@¡]¥ª¤W¨¦³µøµ¡¤u¨ã¡A¥iÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});   %
Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\ko.jpg');


% --- Executes during object creation, after setting all properties.
function edit10_CreateFcn(hObject, eventdata, handles)
```

```matlab
% hObject    handle to edit10 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit11_Callback(hObject, eventdata, handles)
% hObject    handle to edit11 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit11 as text
%        str2double(get(hObject,'String')) returns contents of edit11 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¡¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(11)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(11)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
```

```matlab
    error(11)=1;
else
    set(handles.text17,'string','');
    error(11)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit11_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@²ü-«¤À¥¬«Y¼Æ
km¥Î©ó-×¥¿¦]¾¦½ü¤¤¤ß¶bª°¦w¸Ë©Î»s³y»~®t¡A³y¦¨¾¦¼e¤è¦V¨ü¤O¤£§¡¤Ãª°²¶H¡C
'...
    ,'¡@³o°Ø²¶H¦b¾¦¼e¶V¤j ª°¾¦½ü¤W¶V©úÅã¡A¦]¦¹
km-È·¦ÀH¾¦¼e¼W¤j¦ÓÅÜ¤j¡C','','¡@¡]¥ªª¤W¨¤¡³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡
C¡^'});   % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\km.jpg');


% --- Executes during object creation, after setting all properties.
function edit11_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit11 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

```matlab
function edit12_Callback(hObject, eventdata, handles)
% hObject    handle to edit12 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit12 as text
%        str2double(get(hObject,'String')) returns contents of edit12 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(12)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(12)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(12)=1;
else
    set(handles.text17,'string','');
    error(12)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit12_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
```

```
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¾¦-±±µÄ²À³¤O¤§¥i¾a«×¡]Reliability¡^¡C
','¥i¾a«×«ü²£«~¦b³W©wª°±ø¥ó¤U©M³W©wª°®É¶¡¤°¡A§¹¦¨³W©w¥ô°È⁰¾÷²v¡C'...
      ,'','¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});   %
Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\table 15.6.jpg');


% --- Executes during object creation, after setting all properties.
function edit12_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit12 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit21_Callback(hObject, eventdata, handles)
% hObject    handle to edit21 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit21 as text
%        str2double(get(hObject,'String')) returns contents of edit21 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
```

```matlab
        set(hObject,'ForegroundColor',[1,0,0]);
        error(13)=1;
elseif input2==0
        set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
        set(handles.text17,'ForegroundColor',[1,0,0]);
        set(hObject,'ForegroundColor',[1,0,0]);
        error(13)=1;
elseif input2<0
        set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
        set(handles.text17,'ForegroundColor',[1,0,0]);
        set(hObject,'ForegroundColor',[1,0,0]);
        error(13)=1;
else
        set(handles.text17,'string','');
        error(13)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit21_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¾¦½ü§ªä³¡µw«׬°°I-±¤W¾¦½ü¤¤¤ß»P¾¦®Ú¶
ê¥æÂI¡C'});   % Åã¥Üµù¸Ñ©Î»¡©ú
cla


% --- Executes during object creation, after setting all properties.
function edit21_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit21 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
```

```matlab
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit22_Callback(hObject, eventdata, handles)
% hObject    handle to edit22 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit22 as text
%        str2double(get(hObject,'String')) returns contents of edit22 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¡¦r¦ê¡A-nÂâ´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(14)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(14)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(14)=1;
else
    set(handles.text17,'string','');
    error(14)=0;
end
```

```matlab
guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit22_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¿ï¾Ü-t¸ü©Ó¨ü°ØÃþ¡A¶í¦æ-t¸ü-×¥¿¡C¡','',
'¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});  % Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\table 8.1.jpg');


% --- Executes during object creation, after setting all properties.
function edit22_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit22 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit23_Callback(hObject, eventdata, handles)
% hObject    handle to edit23 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit23 as text
%        str2double(get(hObject,'String')) returns contents of edit23 as
a double
global error
input2 = str2num(get(hObject,'String')); %
```

```matlab
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(15)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(15)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(15)=1;
else
    set(handles.text17,'string','');
    error(15)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit23_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¹êÅçµ²ªGªí©ú¡A¦pªGª½®|¤ñ0.4in¤p¦j¦h¼Æ
ªºª í-±¤§¤U¤ô¥-ªºÀ³¤O¨³³t¤U-°¡C',...


'¡@¦¦¦¹¡¹¡A¹s¥ó¬O¤j©ó0.4-^¤o¡]©Î10mm¡^ªºª½®|¡A¨Ã¥B¸g¨ü-°§áÂàÅs¦±©Î§áÂàÀ
³ÀH¨-Äâ±aªº0.9°¥ÅÜ«Y¼ÆCG¤¤¡A¬Û¦P³¡¥ó©Ó¨ü¶¦V¸ü²ü¡C',...


'¡@«D±`¤pªº³¡¤À¨ã¦³¤ñ¼Ð·Çªº°RR¼¯°¸¼Ë«~¬Æ¦Ü§ó¦³§Qªº±è«×¡C','','¡@¡]¥ª¤W
¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ïªù¡C¡^'});  % Åã¥Üµù¸Ñ©Î»¡©ú
```

齒輪輔助程式設計

```matlab
imshow('.\Picture\table 8.1.jpg');


% --- Executes during object creation, after setting all properties.
function edit23_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit23 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit24_Callback(hObject, eventdata, handles)
% hObject    handle to edit24 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit24 as text
%        str2double(get(hObject,'String')) returns contents of edit24 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-n¡Âà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(16)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(16)=1;
```

```matlab
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(16)=1;
else
    set(handles.text17,'string','');
    error(16)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit24_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@ªí-±«Y¼Æ
Cs¥Î©ó-×¥¿¾¦-±²ÊÁW«׍ªº¼vÅT¡C',...


'¡@³z¹L¤ªªR¦U°Øªí-±¦¦]¤l»P§Ü©Ô±j«׍ªªí-±ª¬°A¡A¦ô-p¥Xªí-±¦]¯ÀCsª°¦ô-p-È
¡C','','¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});  %
Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\figure 8.13.jpg');


% --- Executes during object creation, after setting all properties.
function edit24_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit24 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
```

```matlab
end


function edit29_Callback(hObject, eventdata, handles)
% hObject    handle to edit29 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit29 as text
%        str2double(get(hObject,'String')) returns contents of edit29 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(17)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(17)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(17)=1;
else
   set(handles.text17,'string','');
   error(17)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
```

```matlab
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit29_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¾¦®Ú³¡ÅsÀ³¤O¥i¾a«×¡]Reliability¡^¡C',
'¥i¾a«×«ü²£«~¦b³W©wªº±ø¥ó¤U©M³W©wªº®É¶¡¤°¡A§¹¦¨³W©w¥ô°Èª°¾÷²v¡C'...
    ,'','¡@¡]¥ª¤W¨¤¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ï¤ù¡C¡^'});  %
Åã¥Üµù¸Ñ©Î»¡©ú
imshow('.\Picture\table 15.3.jpg');



% --- Executes during object creation, after setting all properties.
function edit29_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit29 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end




function edit30_Callback(hObject, eventdata, handles)
% hObject    handle to edit30 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit30 as text
%        str2double(get(hObject,'String')) returns contents of edit30 as
a double
global error
input2 = str2num(get(hObject,'String')); %
```

```matlab
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(18)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(18)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(18)=1;
else
    set(handles.text17,'string','');
    error(18)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit1.
function edit30_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@½Ð¿é¤J¤u§@ ·Å«×¡]Äá¤ó¡^'...
    ,'','¡@¤@¯ë¦Ó¨¥¡A¾¦½ü°º§÷½è-Y¬°¿û§÷¡A¤j³¡¤À±¡ªp¤U ·Å«×-×¥¿«Y¼Æ·|¿ï¾
Ü1¡A¦Ó·í¤u§@ ·Å«×¤j©ó160«×(µØ¤ó) ¡A½Ð¥N¡@(620/(420+T))¡@(for
T>160«×(µØ¦¡))'...
    });  % Åã¥Üµù¸Ñ©Î»¡©ú
cla
```

```matlab
% --- Executes during object creation, after setting all properties.
function edit30_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit30 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function edit31_Callback(hObject, eventdata, handles)
% hObject    handle to edit31 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit31 as text
%        str2double(get(hObject,'String')) returns contents of edit31 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¡r¡ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(19)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(19)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
```

```matlab
        set(handles.text17,'ForegroundColor',[1,0,0]);
        set(hObject,'ForegroundColor',[1,0,0]);
        error(19)=1;
else
        set(handles.text17,'string','');
        error(19)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit31_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{''});   % Åã¥Üμù¸Ñ©Î»¡©ú
cla


% --- Executes during object creation, after setting all properties.
function edit31_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit31 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function edit25_Callback(hObject, eventdata, handles)
% hObject    handle to edit25 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```matlab
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit25 as text
%        str2double(get(hObject,'String')) returns contents of edit25 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(20)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(20)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(20)=1;
else
    set(handles.text17,'string','');
    error(20)=0;
end


guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit25_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@§Îª¬¦]¤l¬°µL¦]¦¸°Ñ¼Æ¡A¨ä«Y¼ÆÀHµÛ¾¦½ü¹
```

齒輪輔助程式設計

ïªº¾¦½ü´X°Ñ¼Æ¤Î¨ü¤O-t¸ü¤À¥¬¤£¦P¦Ó§ïÅÜ¡A¨ä-p°â¤W¬Û·í½ÆÂø¡C','¡@Â²©ö-p°
â«h¥i§Q¥Î¬dªíª k¨D±o¡C'...

    ,'','¡@¡]¥ª¤W¨¦³µøµ¡¤u¨ã¡A¥i¥HÁY©ñ©ì©Ô¹Ïù¡C¡^'}); %
Åã¥Üµù¸Ñ©Î»¡©ú

```matlab
imshow('.\Picture\figure 16.8.jpg');




function edit33_Callback(hObject, eventdata, handles)
% hObject    handle to edit33 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit33 as text
%        str2double(get(hObject,'String')) returns contents of edit33 as
a double
global error
input2 = str2num(get(hObject,'String')); %
ÀË´ú¿é¤J¥Î¡]string¹w³]¬°¦r¦ê¡A-nÂà´«¬°¼Æ-È¡^
set(hObject,'ForegroundColor',[0,0,0])
if (isempty(input2))
    set(hObject,'String','½Ð¿é¤J¼Æ-È');
    set(hObject,'ForegroundColor',[1,0,0]);
    error(21)=1;
elseif input2==0
    set(handles.text17,'String','¼Æ-È¤£¥i¬°0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(21)=1;
elseif input2<0
    set(handles.text17,'String','¼Æ-È¤£¥i¤p©ó0');
    set(handles.text17,'ForegroundColor',[1,0,0]);
    set(hObject,'ForegroundColor',[1,0,0]);
    error(21)=1;
else
    set(handles.text17,'string','');
    error(21)=0;
end
```

```matlab
guidata(hObject, handles);


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over edit2.
function edit33_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.text17,'ForegroundColor',[0,0,0])
set(handles.text17,'string',{'¡@¦w¥þ«Y¼Æ
n¬O«ü¤@-Óµ²°c©Î¬O¾÷±ñ©Ò¯à-t²üª°-t¸ü¥i¥H¶W¹L¹w´Á-t¸üª°µ«×¡C',...

'¡@¦w¥þ¨t¼Æ¬°¤j©óµ¥©ó1ª°¼Æ-È¡A¦w¥þ¨t¼Æ¶V°ª¡Aªí¥Üµ²°c©Î¾÷±ñª°¦w¥þ«×¶V°
ª¡A¦ý¤]·N¨ýµÛ¨ä¦¨¥»¤]¬Û¹ï´£°ª¡C'});  % Åã¥Üµù¸Ñ©Î»¡©ú
cla



% --- Executes during object creation, after setting all properties.
function startp_CreateFcn(hObject, eventdata, handles)
% hObject    handle to startp (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% --- Executes on button press in startp.
function startp_Callback(hObject, eventdata, handles)
% hObject    handle to startp (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
global error type

if error==0
    a=str2num(get(handles.edit1,'String'));
    m=str2num(get(handles.edit3,'String'));
    Np=str2num(get(handles.edit4,'String'));
    n=str2num(get(handles.edit5,'String'));
    n1=str2num(get(handles.edit6,'String'));
```

```matlab
w=str2num(get(handles.edit7,'String'));
dn=str2num(get(handles.edit8,'String'));
Sli=str2num(get(handles.edit9,'String'));
ko=str2num(get(handles.edit10,'String'));
km=str2num(get(handles.edit11,'String'));
Cr=str2num(get(handles.edit12,'String'));
nn=str2num(get(handles.edit33,'String'));

Din=str2num(get(handles.edit21,'String'));
Cl=str2num(get(handles.edit22,'String'));
Cg=str2num(get(handles.edit23,'String'));
Cs=str2num(get(handles.edit24,'String'));
kr=str2num(get(handles.edit29,'String'));
ktt=str2num(get(handles.edit30,'String'))*9/5+32;
kms=str2num(get(handles.edit31,'String'));
Jp=str2num(get(handles.edit25,'String'));

if ktt<=160
    kt=1;
else
    kt=(620/(420+ktt));
end

if type==1
    mn=m;
    b=0;
    T=w*0.745*9549/1150 ;   % ³æ¦ì¬° Nm
    T=T*1000;
    Vr=n/n1;
    Ng=round(Np*Vr);
    dp=round(m*Np);
    dg=round(Vr*dp);
    Ft=T/(dp/2);
    v=pi*(dp/25.4)*n/12;
    kv=(1200+v)/1200 ;
    Sn=0.5*0.5*dn*6.896*Cl*Cg*Cs*kr*kt*kms;
    b1=(Ft*(1/m)*kv*ko*km/(Jp*Sn));
```

```matlab
        Sfe=(2.8*Din-69);
        Cli=0.8;
        R=dg/dp;
        I=(sind(a)*cosd(a)*R)/(2*R+2);


        Sh=Sfe*Cli*Cr;
        Cp=190.2;
        b2=((Cp^2)*Ft*kv*ko*km)/((Sh^2)*dp*I);



    elseif type==2

        b=str2num(get(handles.edit2,'String'));
        Sfe=(2.8*dn-69);
        Cp=190.2;    %------¡H
        d=atand(tand(a)/cosd(b)); %----------¤½¨î
        mn=(m./cosd(b));
        dp=round(mn.*Np);
        dg=round(dp*(n/n1));
        v=(pi.*dp.*n/(25.4.*12)) ; %-------------------fpm
        kv=(1200+v)/1200;
        Ft=(33000*w/v) ; %--------³æ¦ìlb
        Ft=Ft*4.44;    %----lb to N
        Fr=Ft*tand(d);
        Fa=Ft*tand(b);
        Sh=Sfe.*Sli.*Cr;

CR=((sqrt((((dp/2)+mn).^2-(dp/2*cosd(d)).^2)+sqrt(((dg/2)+mn).^2-(dg/2
*cosd(d)).^2)-((dp+dg)/2)*sind(d)))/((pi*dp*cosd(d))/Np);
        R=dg/dp;
        I=(sind(d)*cosd(d)*R)/(2*R+2);    %---------p654 ´X¦ó¦]¯À

b1=((Cp.^2).*Ft.*cosd(b).*kv.*ko.*0.93.*km)/((Sh.^2).*dp.*I.*0.95.*CR
);

        Sn=0.5*Din*Cl*Cg*Cs*kr*kt*kms/nn;
        b2=(Ft*(1/m)*kv*ko*0.93*km)/(Sn*Jp);
```

```matlab
    else

    end


    b1str= num2str(b1);
    b2str= num2str(b2);
    set(handles.text15,'string', b1str);
    set(handles.text16,'string', b2str);


    Ng=round(Np*(n/n1));
    allN=[Np Ng];


    if type==1
        knn=round(a.*allN./180*0.5);  %¸ó¾¦¼Æ
        wthick=m.*cosd(a).*(pi.*(knn-0.5).*allN*(tand(a)-a*pi/180));
%¸ó¾¦«p
    elseif type==2

knn=round(allN.*(1/pi*((1+sind(b)^2/(cosd(b)^2+tan(a)^2))*sqrt((cosd(
b)+tand(a)^2)*(1/cosd(b)-1))-(tand(a)-a*pi/180)))) ;  %¸ó¾¦¼Æ
        wthick=mn*cosd(a)*(pi*(knn-0.5)+allN.*(tand(a)-a*pi/180));
%¸ó¾¦«p
    else
    end


    ghh=mn;  %¾¦«aºª
    gdd=2.25*mn;  %¥þ¾¦²`
    alld=[dp dg];
    tdd=alld;  %³»¶êa½®|
    cx=(dp+dg)/2;  %¤¤ß¶Z


    knn1str= num2str(knn(1));
    knn2str= num2str(knn(2));
    set(handles.text56,'string', knn1str);
    set(handles.text57,'string', knn2str);


    wthick1str= num2str(wthick(1));
```

```matlab
    wthick2str= num2str(wthick(2));
    set(handles.text58,'string', wthick1str);
    set(handles.text59,'string', wthick2str);


    ghhstr= num2str(ghh);
    set(handles.text53,'string', ghhstr);


    gddstr= num2str(gdd);
    set(handles.text49,'string', gddstr);


    tdd1str= num2str(tdd(1));
    tdd2str= num2str(tdd(2));
    set(handles.text48,'string', tdd1str);
    set(handles.text55,'string', tdd2str);


    cxstr= num2str(cx);
    set(handles.text51,'string', cxstr);




    if b1 > b2
        set(handles.text40,'string', b1);
        b3=b1;
    else
        set(handles.text40,'string', b2);
        b3=b2;
    end


    set(handles.text17,'ForegroundColor',[0,0,0])
    set(handles.text17,'string',{'¡@¤@¯ë¾¦-±¼e³]-p¤§«ØÄ³-È¬° 9-¿¼Ò¼Æ¨ì
14-¿¼Ò¼Æ¤§¶¡¡C'});


    if b3 > 9*m
        set(handles.text41,'string', num2str(round(b3)));
    else
        set(handles.text41,'string', num2str(10*m));
    end
else
```

```matlab
    errordlg('¦³¤£¥¿½T¤§³]©w-È¡AµLªk¹B°â¡I','Äµ§i')
end


guidata(hObject, handles);


% a = str2num(get(handles.edit1,'String'));
% b = str2num(get(handles.edit2,'String'));
% guidata(hObject, handles); % §ó·sµ²°cÅé



% --- Executes on button press in clearx.
function clearx_Callback(hObject, eventdata, handles)
% hObject    handle to clearx (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
set(handles.edit1,'String','');
set(handles.edit2,'String','');
set(handles.edit3,'String','');
set(handles.edit4,'String','');
set(handles.edit5,'String','');
set(handles.edit6,'String','');
set(handles.edit7,'String','');
set(handles.edit8,'String','');
set(handles.edit9,'String','');
set(handles.edit10,'String','');
set(handles.edit11,'String','');
set(handles.edit12,'String','');

set(handles.edit21,'String','');
set(handles.edit22,'String','');
set(handles.edit23,'String','');
set(handles.edit24,'String','');
set(handles.edit29,'String','');
set(handles.edit30,'String','');
set(handles.edit31,'String','');
set(handles.edit33,'String','');
set(handles.edit25,'String','');
set(handles.text15,'String','');
```

```matlab
set(handles.text16,'String','');
set(handles.text40,'String','');
set(handles.text41,'String','');
set(handles.text56,'String','');
set(handles.text57,'String','');
set(handles.text58,'String','');
set(handles.text59,'String','');
set(handles.text48,'String','');
set(handles.text55,'String','');
set(handles.text53,'String','');
set(handles.text49,'String','');
set(handles.text51,'String','');




% --- Executes during object creation, after setting all properties.
function edit25_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit25 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



% --- Executes on mouse press over axes background.
function axes1_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to axes1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --- Executes during object creation, after setting all properties.
function recode_CreateFcn(hObject, eventdata, handles)
% hObject    handle to recode (see GCBO)
```

齒輪輔助程式設計

```matlab
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called
global dindex data;
dindex=5;
datademo=[
0.0200 0.0200 0.0020 0.0200 1.1500 0.3000 0.0050 0.6200 0.0008 0.0015
0.0015 0.0008 0.7790 0.0010 0.0010 0.0006 0.0004 0.0008 0.0250 0.0014
0.0010 0.0145 0.0195 0.0195 0.0200 0.0020 0.0060 0.0100 0.0369 0.0430
0.1650 0.0021 0.0048 0.1040;
0.0200     0 0.0020 0.0200 1.1500 0.3000 0.0050 0.6200 0.0008 0.0015
0.0015 0.0008 0.7790 0.0010 0.0010 0.0006 0.0004 0.0008 0.0250 0.0014
0.0010 0.0081 0.0189 0.0189 0.0200 0.0010 0.0040 0.0009 0.0237 0.0400
0.1530 0.0020 0.0045 0.0965;
0.0200     0 0.0050 0.0200 1.1500 0.3000 0.0050 0.6200 0.0008 0.0015
0.0015 0.0008 0.7790 0.0010 0.0010 0.0006 0.0004 0.0008 0.0250 0.0014
0.0010 0.0018 0.0043 0.0043 0.0500 0.0010 0.0040 0.0022 0.0593 0.1000
0.3830 0.0050 0.0113 0.2415;
0.0200 0.0200 0.0050 0.0200 1.1500 0.3000 0.0050 0.3000 0.0008 0.0015
0.0015 0.0008 0.3000 0.0010 0.0010 0.0006 0.0004 0.0008 0.0250 0.0014
0.0010 0.0158 0.0118 0.0158 0.0500 0.0020 0.0060 0.0251 0.0921 0.1060
0.4060 0.0053 0.0120 0.2560;
0.0200 0.0200 0.0050 0.0200 1.1500 0.3000 0.0050 0.1000 0.0008 0.0015
0.0015 0.0008 0.1000 0.0010 0.0010 0.0006 0.0004 0.0008 0.0250 0.0014
0.0010 0.2110 0.0354 0.2110 0.2110 0.0020 0.0060 0.0251 0.0921 0.1060
0.4060 0.0053 0.0120 0.2560;
];
data=datademo.*1000;


% --- Executes on button press in recode.
function recode_Callback(hObject, eventdata, handles)
% hObject    handle to recode (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
global dindex data type error;
da1=str2num(get(handles.edit1,'String'));
if type==1
    da2=0;
```

```
elseif type==2
    da2=str2num(get(handles.edit2,'String'));
else
end

da3=str2num(get(handles.edit3,'String'));
da4=str2num(get(handles.edit4,'String'));
da5=str2num(get(handles.edit5,'String'));
da6=str2num(get(handles.edit6,'String'));
da7=str2num(get(handles.edit7,'String'));
da8=str2num(get(handles.edit8,'String'));
da9=str2num(get(handles.edit9,'String'));
da10=str2num(get(handles.edit10,'String'));
da11=str2num(get(handles.edit11,'String'));
da12=str2num(get(handles.edit12,'String'));
da13=str2num(get(handles.edit21,'String'));
da14=str2num(get(handles.edit22,'String'));
da15=str2num(get(handles.edit23,'String'));
da16=str2num(get(handles.edit24,'String'));
da17=str2num(get(handles.edit25,'String'));
da18=str2num(get(handles.edit29,'String'));
da19=str2num(get(handles.edit30,'String'));
da20=str2num(get(handles.edit31,'String'));
da21=str2num(get(handles.edit33,'String'));
da22=str2num(get(handles.text15,'String'));
da23=str2num(get(handles.text16,'String'));
da24=str2num(get(handles.text40,'String'));
da25=str2num(get(handles.text41,'String'));
da26=str2num(get(handles.text56,'String'));
da27=str2num(get(handles.text57,'String'));
da28=str2num(get(handles.text58,'String'));
da29=str2num(get(handles.text59,'String'));
da30=str2num(get(handles.text48,'String'));
da31=str2num(get(handles.text55,'String'));
da32=str2num(get(handles.text53,'String'));
da33=str2num(get(handles.text49,'String'));
da34=str2num(get(handles.text51,'String'));
```

```matlab
localdata=[da1 da2 da3 da4 da5 da6 da7 da8 da9 da10 da11 da12 da13 da14
da15 da16 da17 da18 da19 da20 da21 ...
    da22 da23 da24 da25 da26 da27 da28 da29 da30 da31 da32 da33 da34];


if numel(localdata)==34
    daempty=1;
else
    daempty=0;
end


if sum(error)==1
    errordlg('¦³¼Æ-È®æ¿é¤J¿ù»~¡AÀx¦s¥¢±Ñ¡I','Äµ§i')
elseif daempty==1
    dindex = dindex+1;
    data=[data;localdata];
    set(handles.slider1,'Min',0,'Max',dindex);
    set(handles.text64,'String',dindex);
else
    errordlg('¦³¼Æ-È®æ¬°ªÅ¡AÀx¦s¥¢±Ñ¡I','Äµ§i')
end


% --- Executes during object creation, after setting all properties.
function edit33_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit33 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

```matlab
% --- Executes on slider movement.
function slider1_Callback(hObject, eventdata, handles)
% hObject    handle to slider1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'Value') returns position of slider
%        get(hObject,'Min') and get(hObject,'Max') to determine range of
slider
global data;
val0=round(get(handles.slider1, 'value'));
if val0==0
    set(handles.slider1,'Value',1);
end

valstr=num2str(round(get(handles.slider1, 'value')));
val=str2num(valstr);
set(handles.edit34,'string',valstr);
da1str=num2str(data(val,1));
da2str=num2str(data(val,2));
da3str=num2str(data(val,3));
da4str=num2str(data(val,4));
da5str=num2str(data(val,5));
da6str=num2str(data(val,6));
da7str=num2str(data(val,7));
da8str=num2str(data(val,8));
da9str=num2str(data(val,9));
da10str=num2str(data(val,10));
da11str=num2str(data(val,11));
da12str=num2str(data(val,12));
da13str=num2str(data(val,13));
da14str=num2str(data(val,14));
da15str=num2str(data(val,15));
da16str=num2str(data(val,16));
da17str=num2str(data(val,17));
da18str=num2str(data(val,18));
da19str=num2str(data(val,19));
da20str=num2str(data(val,20));
```

```matlab
da21str=num2str(data(val,21));
da22str=num2str(data(val,22));
da23str=num2str(data(val,23));
da24str=num2str(data(val,24));
da25str=num2str(data(val,25));
da26str=num2str(data(val,26));
da27str=num2str(data(val,27));
da28str=num2str(data(val,28));
da29str=num2str(data(val,29));
da30str=num2str(data(val,30));
da31str=num2str(data(val,31));
da32str=num2str(data(val,32));
da33str=num2str(data(val,33));
da34str=num2str(data(val,34));


if data(val,2)==0
    set(handles.type1,'Value',1)
    set(handles.type2,'Value',0)
    set(handles.text1,'string','À£¤O¨¤  («×)')
    set(handles.text2,'Visible','off')
    set(handles.edit2,'Visible','off')
else
    set(handles.type1,'Value',0)
    set(handles.type2,'Value',1)
    set(handles.text1,'string','¾î¦VÀ£¤O¨¤  («×)')
    set(handles.text2,'Visible','on')
    set(handles.edit2,'Visible','on')

end


set(handles.edit1,'String',da1str);
set(handles.edit2,'String',da2str);
set(handles.edit3,'String',da3str);
set(handles.edit4,'String',da4str);
set(handles.edit5,'String',da5str);
set(handles.edit6,'String',da6str);
set(handles.edit7,'String',da7str);
```

```matlab
set(handles.edit8,'String',da8str);
set(handles.edit9,'String',da9str);
set(handles.edit10,'String',da10str);
set(handles.edit11,'String',da11str);
set(handles.edit12,'String',da12str);
set(handles.edit21,'String',da13str);
set(handles.edit22,'String',da14str);
set(handles.edit23,'String',da15str);
set(handles.edit24,'String',da16str);
set(handles.edit25,'String',da17str);
set(handles.edit29,'String',da18str);
set(handles.edit30,'String',da19str);
set(handles.edit31,'String',da20str);
set(handles.edit33,'String',da21str);
set(handles.text15,'String',da22str);
set(handles.text16,'String',da23str);
set(handles.text40,'String',da24str);
set(handles.text41,'String',da25str);
set(handles.text56,'String',da26str);
set(handles.text57,'String',da27str);
set(handles.text58,'String',da28str);
set(handles.text59,'String',da29str);
set(handles.text48,'String',da30str);
set(handles.text55,'String',da31str);
set(handles.text53,'String',da32str);
set(handles.text49,'String',da33str);
set(handles.text51,'String',da34str);




% --- Executes during object creation, after setting all properties.
function slider1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to slider1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: slider controls usually have a light gray background.
```

```matlab
if isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor',[.9 .9 .9]);
end




function edit34_Callback(hObject, eventdata, handles)
% hObject    handle to edit34 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit34 as text
%        str2double(get(hObject,'String')) returns contents of edit34 as
a double
global dindex
input=str2num(get(habdles.edit34,'string'));
if input>dindex
    set(handles.edit34,'string',dindex);
end
xx=str2num(get(handles.edit34,'string'));
set(handles.slider1,'Value',xx);



% --- Executes during object creation, after setting all properties.
function edit34_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit34 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

```matlab
function edit35_Callback(hObject, eventdata, handles)
% hObject    handle to edit35 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit35 as text
%        str2double(get(hObject,'String')) returns contents of edit35 as a double


% --- Executes during object creation, after setting all properties.
function edit35_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit35 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```