實驗三 AUTO

一、The pitchfork bifurcation

(1) Supercritical case

$$\frac{dx}{dt} = \mu x - x^3$$

(2) Subcritical case

$$\frac{dx}{dt} = \mu x + x^3$$

分別實現(1),(2)的程式碼，並附上 AUTO 計算結果

二、ab: A Programmed Demo(檔案位置在 C:\auto\07p\demos\ab)

This demo illustrates the computation of stationary solutions, Hopf bifurcations and periodic solutions. The equations, that model an A → B reaction, are those from Uppal, Ray & Poore(1974), namely

$\dot{u}_1 = -u_1 + p_1(1-u_1)e^{u_2}$

$\dot{u}_2 = -u_2 + p_1 p_2(1-u_1)e^{u_2} - p_3 u_2$

where u_1 and u_2 are state variables. p_1, p_2 and p_3 are parameters.

Let start point (u_1, u_2) be (0,0) and (p_1, p_2, p_3) be (0,8,3).

透過 ab.auto 的 script file 了解指令與實際上的意義，

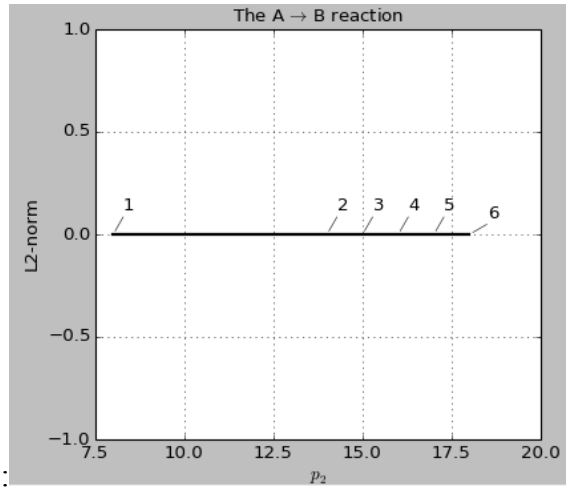
範例:

```
#=============
# AUTO Demo ab
#=============

print "\n***Generate starting data***"
start=run(e='ab',c='ab.1')
```

答：執行 equation file, 使用 constant file “c.ab.1”

結果:



由於在 constant file “c.ab.1”中的設定

UZR = {2: [14.0, 15.0, 16.0, 17.0]} UZSTOP={2: 18.0}

UZR 使用方式:{參數索引:[參數數值,…]}，UZSTOP 使用方式與 UZR 相同

代表 solution 可以在$p_2 = 14,15,16,17$且在18停止，也就是圖中的第 2 到第 6 點。第 1 點為起始值。

(1) 觀察“c.ab.2”與“c.ab.1”的差別，說明過程與執行結果為何？

```
print "\n***Compute stationary solution families***"
ab = []
for solution in start():
    ab = ab + run(solution,c='ab.2')

print "\n***Relabel and save the output files***"
ab=rl(ab)
sv(ab,'ab')
```

(2) 觀察“c.ab.3”與“c.ab.2”的差別，說明過程與執行結果為何？

```
print "\n***Compute periodic solution families***"
for solution in ab("HB"):
    ab = ab + run(solution,c='ab.3')

print "\n***Relabel and save the output files***"
ab=rl(ab)
sv(ab,'ab')
```

三、心得