

# Cyclist relaxation methods

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## 1 Cyclist relaxation methods for the Hénon and Ikeda maps

- `CyclHenon.m` – This procedure computes the prime cycles of the Hénon map (for the parameters  $a = 1.4$  and  $b = 0.3$ ) by the cyclist relaxation method.
- `CyclIkeda.m` – This procedure computes the periodic orbits of the Ikeda map by the cyclist relaxation method.
- `DiscrCyclIkeda.m` – This procedure computes the periodic orbits of the Ikeda map by the *discrete* cyclist relaxation method.

**Example:**

```
>> CyclHenon(6)
```

```
period =
```

```
-0.7277616264  
+0.5795436607  
+0.3114523155  
+1.0380595355  
-0.4151589443  
+1.0701181320
```

```
period =
```

```
+0.4853358626  
+0.8028017261  
+0.2433139027  
+1.1579582005  
-0.8042199010  
+0.4419099514
```

## 2 Illustration of the cyclist relaxation method

- `VFIkedaFig1.m` – Plot of typical trajectories of the vector field  $\dot{x} = f(x) - x$  for the stabilization of a hyperbolic fixed point of the Ikeda map located at  $(x, y) \approx (0.53275, 0.24689)$ .
- `VFIkedaFig2.m` – Plot of typical trajectories of the vector field  $\dot{x} = C(f^3(x) - x)$  for a hyperbolic fixed point  $(x, y) \approx (-0.13529, -0.37559)$  of  $f^3$ , where  $f$  is the Ikeda map. The circle indicates the position of the fixed point. For the vector field corresponding to (a)  $\mathbf{C} = \mathbf{1}$ ,  $x_*$  is a hyperbolic stationary point of the flow, while for (b)  $\mathbf{C} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ ,  $x_*$  is an attracting stationary point.

### Reference:

Chapter *Fixed points, and how to get them*  
Section *Periodic orbits as extremal orbits*

P. Cvitanović, R. Artuso, R. Mainieri, G. Tanner and G. Vattay, *Classical and Quantum Chaos*, [www.nbi.dk/ChaosBook/](http://www.nbi.dk/ChaosBook/), Niels Bohr Institute (Copenhagen 2001)