Temas de investigación
AUTOMATA CELULAR

Genaro Juárez Martínez
http://uncomp.uwe.ac.uk/genaro/

iGEM México
Diciembre del 2007

Temas de investigación
AUTOMATA CELULAR

- Spiral Rule (or Beehave Rule)
- Diffusion Rule
- CA activador-inhibidor de cuatro estados
- CA con crecimiento
- CA con memoria
- CA particionado (PCA 16 states)
- Vida y evolución en computadoras

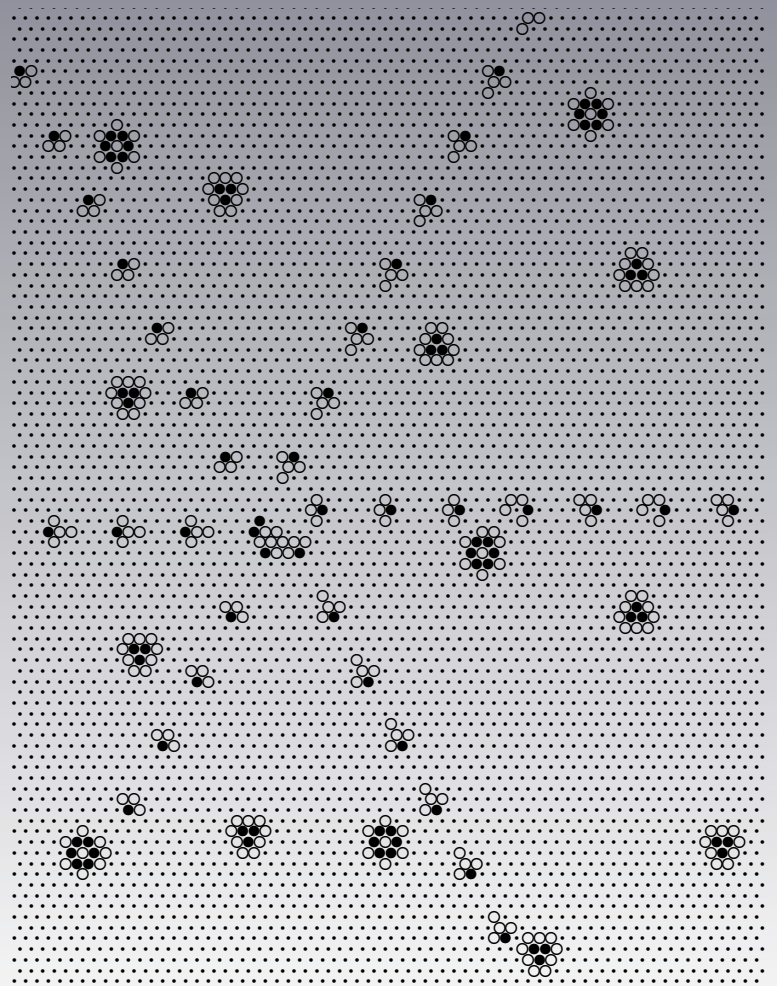
Spiral Rule hexagonal 2D, 3-states CA

Computing in 'spiral rule' reaction-diffusion hexagonal cellular automaton

Andrew Adamatzky[1] and Andrew Wuensche[2]

[1] *Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol BS16 1QY, United Kingdom*
Andrew.Adamatzky@uwe.ac.uk

[2] *Discrete Dynamics Lab, United Kingdom*
andy@ddlab.org



Spiral Rule hexagonal 2D, 3-states CA

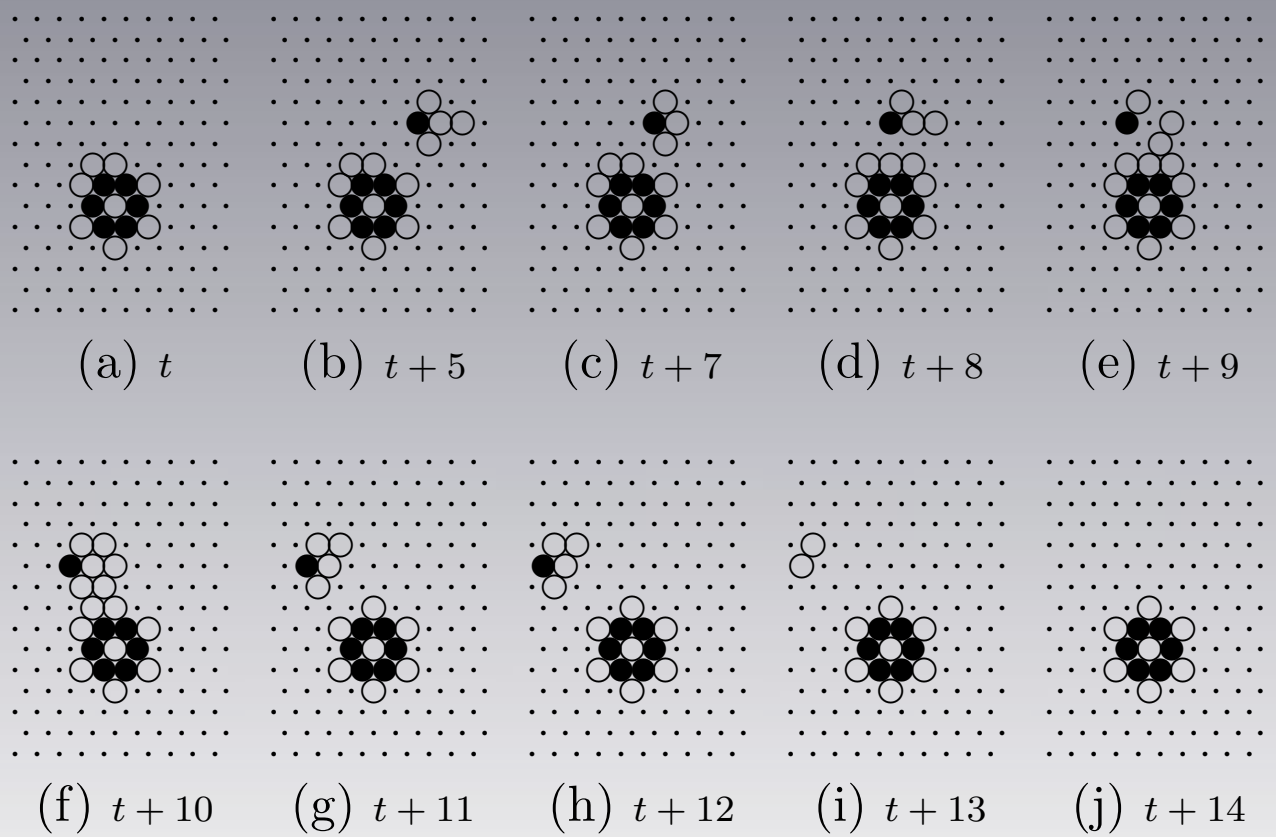


Fig. 11. Read and erase bit.

Spiral Rule hexagonal 2D, 3-states CA

	a	b	c	d	e	f	g
α	βb	δc	αb	αe	δd	αe	δc
β	αd	δe	βc	βc	χg	αa	χe
χ	χd	βe	δf	χa	βb	χa	βe
δ	δb	βc	χg	χe	αf	δe	αa

Fig. 19. The state transition table of the eater-glider machine. Tuple xy, a pair made up of an eater state x and glider state y, at the intersection of the ith row and jth column, signifies that being in state i while receiving input j the machine takes state x and generates output y.

Spiral Rule hexagonal 2D, 3-states CA

objetivos generales:

- Implementar un algoritmo (Turing completo) con las compuertas lógicas establecidas. Demostrar su computación universal.
- Implementar osciladores particionados basados en glider guns espirales.
- Implementar fenómenos químicos desde sus estados: activador, inhibidor y refractorio.

Diffusion Rule 2D, 3-states CA

Localization dynamics in a binary two-dimensional cellular automaton: the Diffusion Rule

Genaro Juárez Martínez[1,2]
Andrew Adamatzky[2]
Harold V. McIntosh[3]

[1] Departamento de Posgrado, Escuela Superior de Cómputo, Instituto Politécnico Nacional, México.
E-mail: genarojm@correo.unam.mx
http://uncomp.uwe.ac.uk/genaro/

[2] Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol, United Kingdom.
E-mail: andrew.adamatzky@uwe.ac.uk
http://uncomp.uwe.ac.uk/adamatzky/

[3] Departamento de Aplicación de Microcomputadoras, Instituto de Ciencias, Universidad Autónoma de Puebla, Puebla, México.
E-mail: mcintosh@servidor.unam.mx
http://delta.cs.cinvestav.mx/~mcintosh/

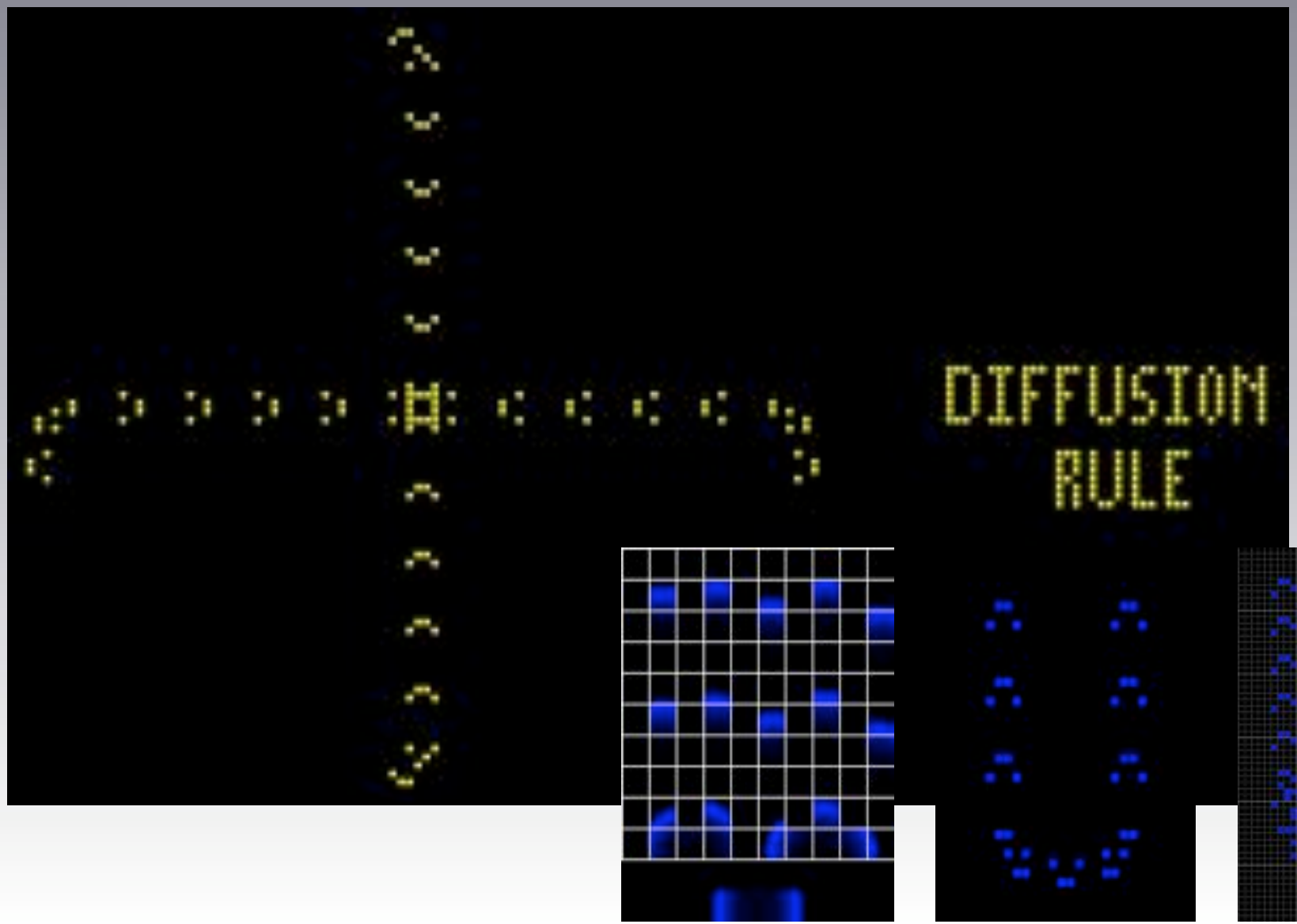
Diffusion Rule 2D, 2-states CA

We have found a cluster of semi-totalistic rules supporting structures of the Diffusion Rule. They are $B2/S2\ldots8$ called *Life* $dc22^7$ where d and c take values between 2 and 8, and $d \leq c$. Therefore, we found that the rule $B2/S7$ or $R(7722)$ exhibits most reach dynamics of localized patterns amongst all the rules studied by us. Rules of the local transition are simple:

1. A cell in state 0 will take state 1 if it has exactly two neighbors in state 1, otherwise cell remains in state 0.

2. A cell in state 1 remains in state 1 if it has exactly seven neighbors in state 1, otherwise cell takes state 0.

Diffusion Rule
2D, 2-states CA



Diffusion Rule 2D, 2-states CA

objetivos generales:

- Implementar un algoritmo (Turing completo) con las compuertas lógicas establecidas. Demostrar su computación universal.
- Implementar patrones complejos sincronizados.
- Cerrar el conjunto de funciones relacionadas a Diffusion Rule.

CA con crecimiento

A note in growth and nucleation with binary two-dimensional cellular automata

Genaro Juárez Martínez[1]
Andrew Adamatzky[2]
Jonathan Mills[3]

April, 2008

[1] Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol, United Kingdom.
E-mail: genarojm@correo.unam.mx
http://uncomp.uwe.ac.uk/genaro/
[2] Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol, United Kingdom.
E-mail: andrew.adamatzky@uwe.ac.uk
http://uncomp.uwe.ac.uk/adamatzky/
[3] Cognitive Science Program, Indiana University, United States of America.
E-mail: jwmills@indiana.edu
http://www.cogs.indiana.edu/people/homepages/mills.html

CA con crecimiento

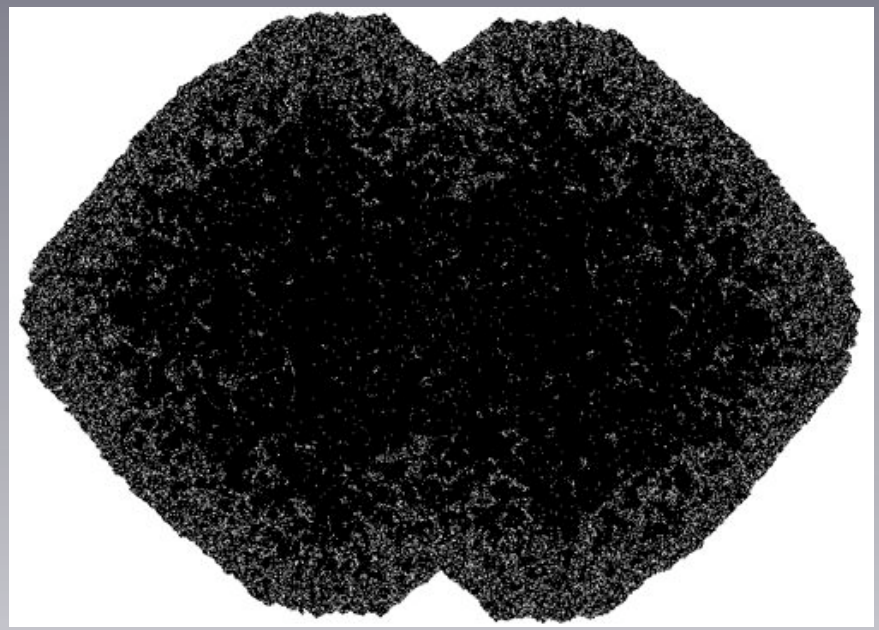


Figure 5: Fusing waves later of a collision between two waves in different phases. Evolution rule f_1.

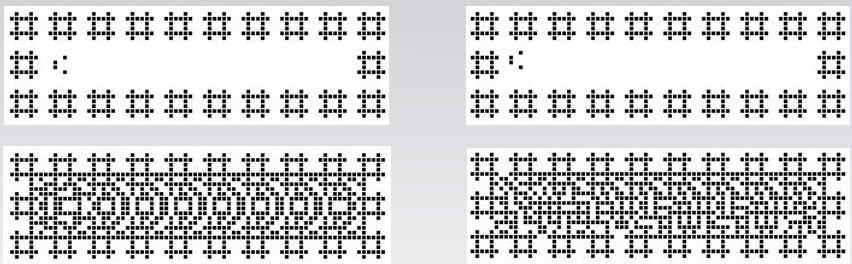


Figure 9: Identifying patterns like wave propagation in channels of information stimulated with mobile self-localizations.

CA con crecimiento

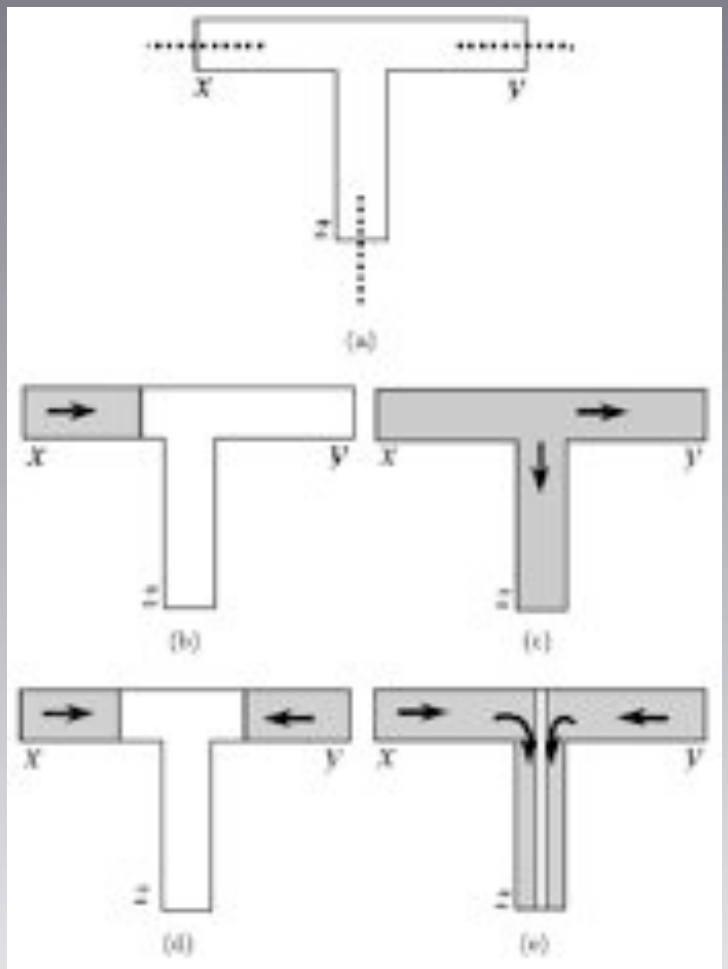


Figure 12: Schematic demonstration of the XOR gate. (a) The gate's architecture; sites at which the state of the reactor is measured are shown by the dotted lines. (b) A reactant is added to one of the inputs, $x = T$, the reactant then diffuses along the chambers of the gate and (c) reaches an output, $z = T$. (d) A reactant is added to both inputs simultaneously, $x = y = T$, two wave fronts are initiated and move towards one another, where they interact to form an uncoloured bisector (e), $z = F$ [2].

CA con crecimiento

objetivos generales:

- Implementar un algoritmo (Turing completo) con las compuertas lógicas establecidas. Demostrar su computación universal.
- Establecer su capacidad para implementar computación cuántica y no-convencional.

Nota: esta investigación tomará un poco más de tiempo que los proyectos anteriores, inicialmente, pero con resultados originales en el área.

Referencias

Spiral Rule

[1] Adamatzky, A., & A. Wuensche, (2007), "Computing in Spiral Rule Reaction-Diffusion Hexagonal Cellular Automaton", Complex Systems, vol.16, issue 4.

[2] Wuensche, A., & A. Adamatzky, (2006), "On spiral glider-guns in hexagonal cellular automata: activator-inhibitor paradigm", International Journal of Modern Physics C, Vol. 17, No. 7, 1009-1026.

[3] Adamatzky, A., A. Wuensche, & B. De Lacy Costello, (2006), "Glider-based computing in reaction-diffusion hexagonal cellular automata", Chaos, Solitons & Fractals, Volume 27, Issue 2, 2006, 287-295.

[4] Wuensche A., Self-reproduction by glider collisions; the beehive rule, ALife 9 Proceedings (The MIT Press, 2004) 286–291.

Referencias

Patterns formations

[1] Adamatzky, A., Juarez Martınez, G. and Seck Tuoh Mora, J. C., Phenomenology of reaction-diffusion binary-state cellular automata, Int. J. Bifurcation and Chaos 16 (10), 1–21, 2006.

[2] Magnier M., Lattaud C. and Heudin J.-C. Complexity classes in the two-dimensional Life cellular automata subspace, Complex Systems 11 (1997) 419–436.

CA con crecimiento

[1] Juarez Martınez, G., Adamatzky, A. and Mills, J., A note in growth and nucleation with binary two-dimensional cellular automata, in elaboration.

[2] Gravner, J., Growth Phenomena in Cellular Automata, in New Constructions in Cel lular Automata, (D. Griffeath and C. Moore, eds.), Oxford University Press, 2003.

Referencias

Diffusion Rule

[1] Juarez Martınez, G., Adamatzky, A. and McIntosh, H.V., "Localization dynamic in a binary two-dimensional cellular automaton: the Diffusion Rule," Journal of Cel lular Automata, in press.

[2] Juarez Martınez, G., Mechaca, A. and Mecate, M., Un subconjunto de autómata celular con comportamiento complejo en dos dimensiones , ESCOM-IPN, 2005. http://uncomp.uwe.ac.uk/genaro/papers/.