(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 230 793 A8**

(12) **CORRECTED EUROPEAN PATENT APPLICATION**

(15) Correction information:
**Corrected version no 1 (W1 A2)**
**Corrections, see**
**Bibliography INID code(s) 71, 72**

(48) Corrigendum issued on:
**16.02.2011 Bulletin 2011/07**

(43) Date of publication:
**22.09.2010 Bulletin 2010/38**

(21) Application number: **09157043.2**

(22) Date of filing: **31.03.2009**

(51) Int Cl.:
***H04L 9/32*** *(2006.01)* ***H01Q 15/00*** *(2006.01)*
***H01Q 17/00*** *(2006.01)*

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR**
Designated Extension States:
**AL BA RS**

(30) Priority: **16.03.2009 EP 09003764**
**16.03.2009 EP 09003763**

(71) Applicants:
- **Technische Universität München**
  **80333 München (DE)**
- **Rührmair, Ulrich**
  **83679 Sachsenkam (DE)**

(72) Inventors:
- **Stutzmann, Martin**
  **85435 Erding (DE)**
- **Csaba, György**
  **80634 München (DE)**
- **Schlichtmann, Ulf**
  **81549 München (DE)**
- **Lugli, Paolo**
  **85399 Halfbergmoos (DE)**
- **Rührmair, Ulrich**
  **83679 Sachsenkam (DE)**

(74) Representative: **Herrmann, Franz**
**Dendorfer & Herrmann**
**Patentanwälte Partnerschaft**
**Bayerstrasse 3**
**80335 München (DE)**

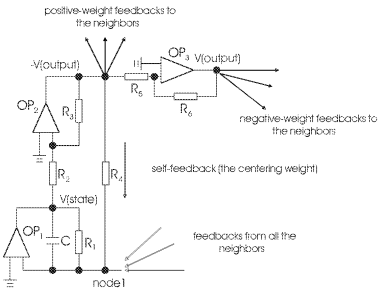
(54) **On-Chip Electric Waves: An Analog Circuit Approach to Physical Uncloneable Functions: PUF**

(57) This application proposes the use of Cellular Non-Linear Networks (CNNs) as physical uncloneable functions (PUFs). We argue that analogue circuits offer higher security than existing digital PUFs and that the CNN paradigm allows us to build large, unclonable, and scalable analogue PUFs, which still show a stable and repeatable input-output behaviour.

CNNs are dynamical arrays of locally-interconnected cells, with a cell dynamics that depends upon the interconnection strengths to their neighbours. They can be designed to evolve in time according to partial differential equations. If this equation describes a physical phenomenon, then the CNN can simulate a complex physical system on-chip. This can be exploited to create electrical PUFs with high relevant structural information content.

To illustrate our paradigm at work, we design a circuit that directly emulates nonlinear wave propagation phenomena in a random media. It effectively translates the complexity of optical PUFs into electrical circuits. This, leading to better practicality, while maintaining or even improving the security properties of their optical counterparts.

FIG 18




EP 2 230 793 A8