



DEPARTAMENTO DE INGENIERIA ELECTRICA  
SECCION DE ELECTRONICA DEL ESTADO SÓLIDO

## GRUPO DE SISTEMAS VLSI

### Investigadores:

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Dr. Mario A. Reyes Barranca

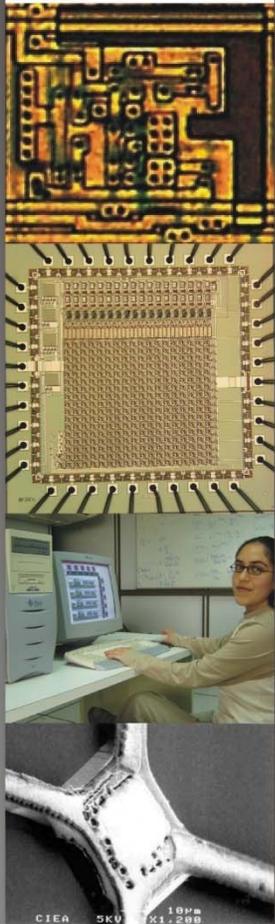
Dr. Felipe Gómez Castañeda

### Auxiliares de Investigación:

Dr. Oliverio Cárdenas Arellano

M. C. Luis Martín Flores Nava

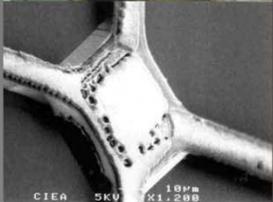
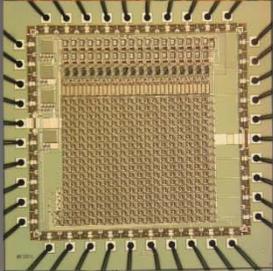
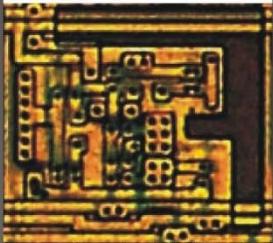
M. I. Emilio Rafael Espinosa García



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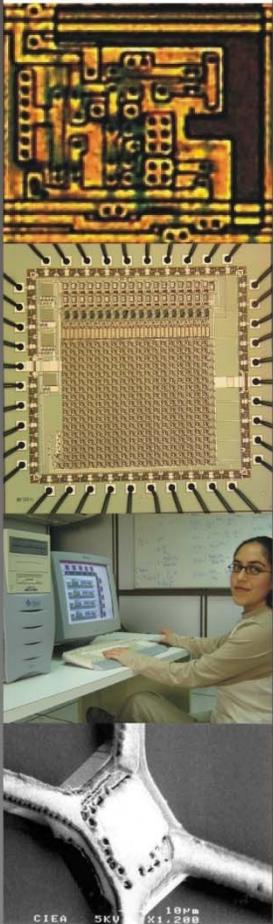
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## Líneas de Investigación

- ❑ Diseño de Circuitos Integrados Analógicos CMOS
- ❑ Desarrollo de Prototipos en Tecnología de Componentes VLSI digitales-FPGA



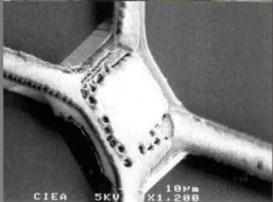
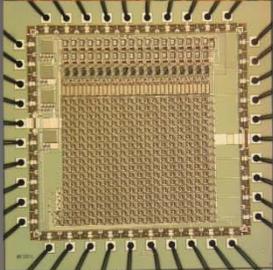
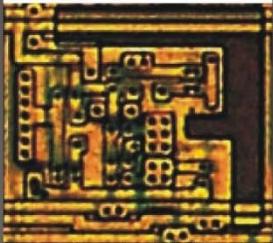
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## Líneas de Investigación

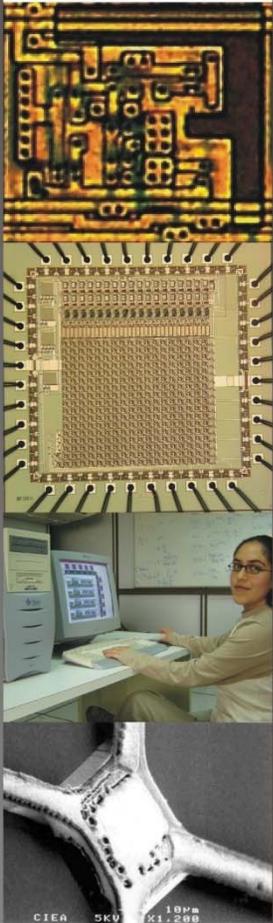
- ❑ Diseño de Sistemas MEMS (Micro-Electro-Mechanical Systems)
- ❑ Desarrollo de Métodos para Análisis de Datos basados en Técnicas Neurodifusas



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# Temas de Investigación

1. Diseño, fabricación y caracterización de circuitos integrados CMOS para:
  - Sistema de detección de movimiento para coordinación visual-motora de brazo robótico en tiempo real.
  - Sistema de análisis de imágenes en tiempo-real con estructura de red neuronal celular
  - Sistema de predicción en series de datos muestreados
  - Sistema de conversión analógica-digital basado en modulador sigma-delta



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# Temas de Investigación

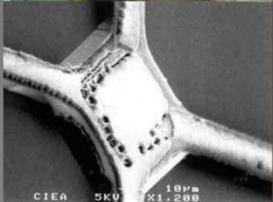
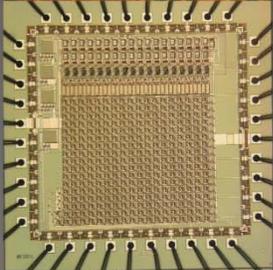
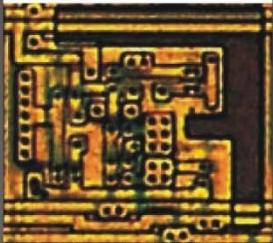
2. Diseño, construcción y caracterización de sistemas en tecnología de componentes FPGA
  - Sistema de control de un vehículo prototipo basado en algoritmos de lógica difusa
  - Robot autónomo con procesamiento de visión empleando una tarjeta Spartan 3E
  - Sistema de análisis de señales basado en teoría de componentes principales y con estructura de red neuronal artificial



# Temas de Investigación

## 3. Diseño, fabricación y caracterización de MEMs para:

- Ejemplo de lo que son MEMS
- Sistema de detección de gases

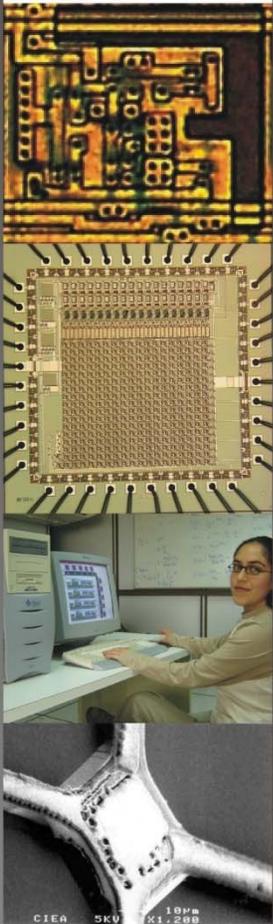


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## Temas de Investigación

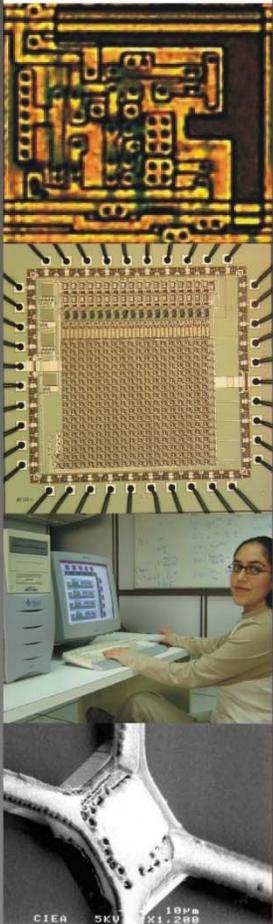
4. Desarrollo de métodos para análisis de datos basados en técnicas neurodifusas
  - Modelación de biopilas
  - Programa de cómputo para estimar la proporción de tipos de crudo en una mezcla de hidrocarburos
  - Detección de arritmias PVC



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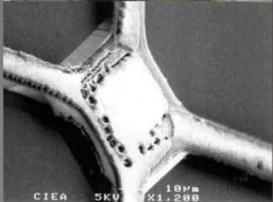
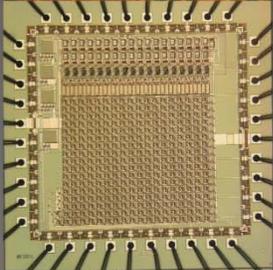
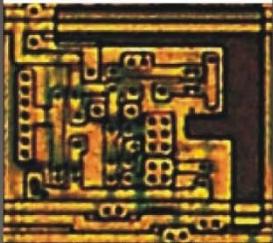
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## Infraestructura

- Red de computadoras personales y estaciones de trabajo
- Software de diseño a nivel sistema, eléctrico y nivel tecnológico
- Equipo para mediciones eléctricas y de desempeño de tarjetas en tecnología analógica, digital y mixta



# Laboratorio de diseño

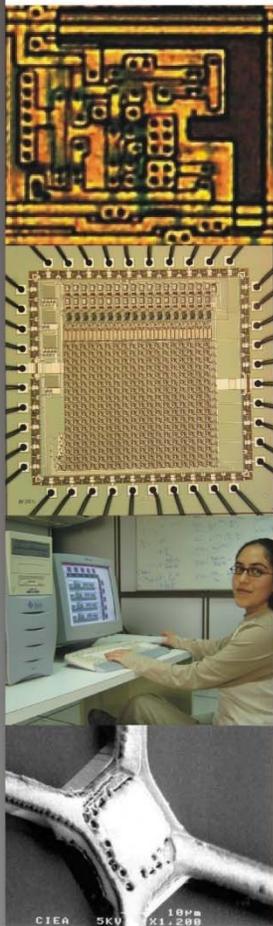


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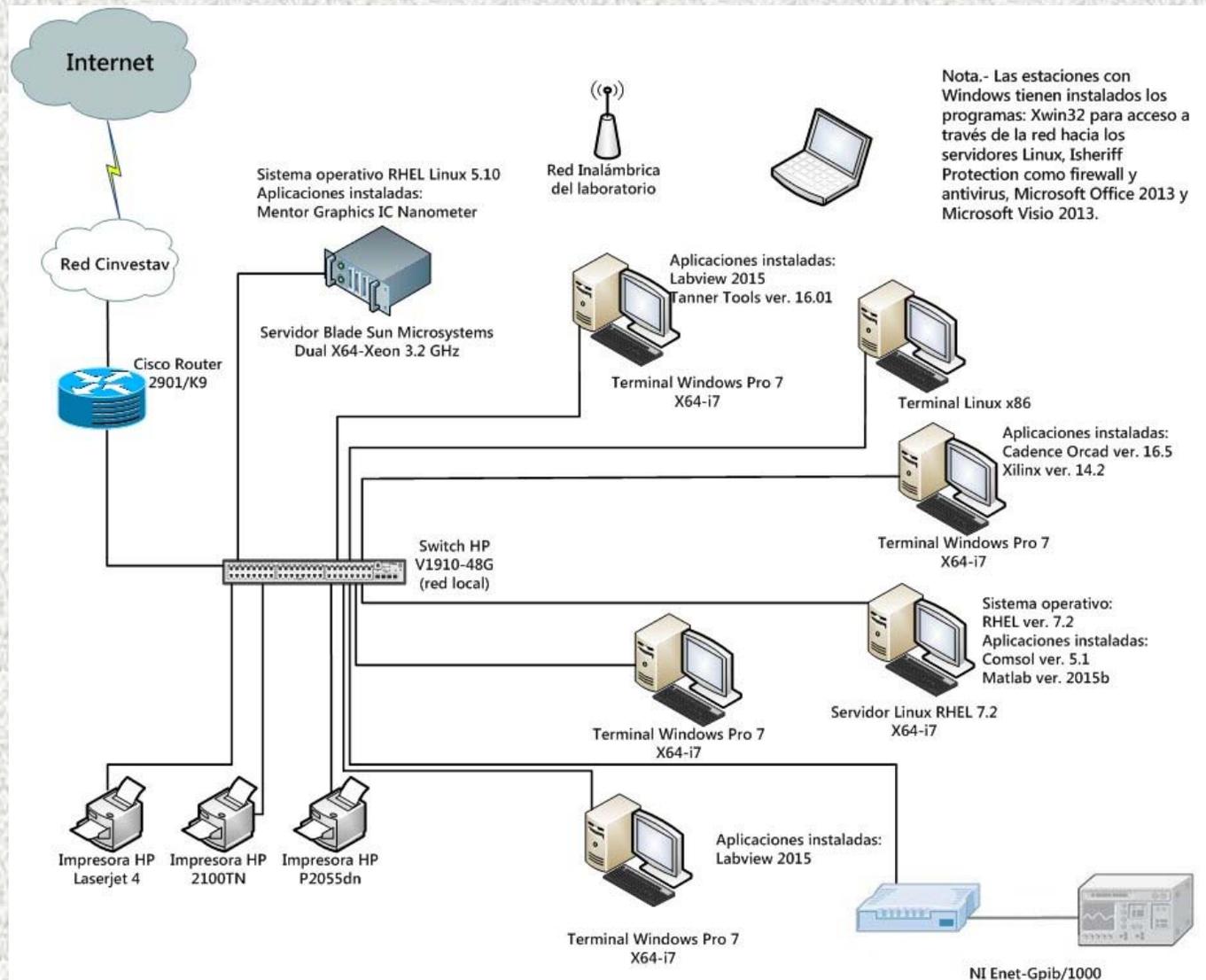




# Laboratorio de diseño

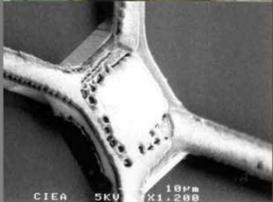
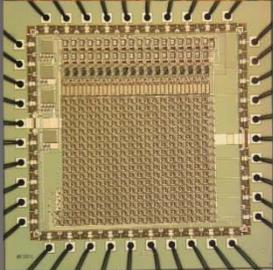
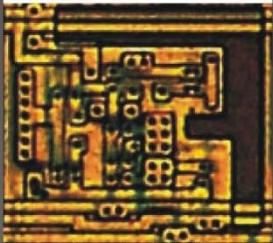


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**SISTEMAS VLSI**

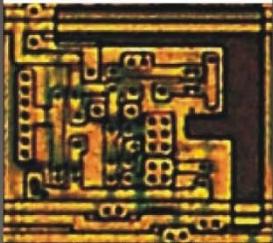
# Fin de la presentación



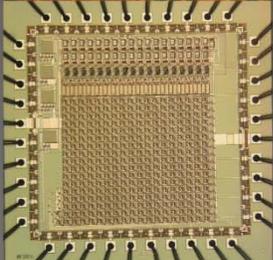




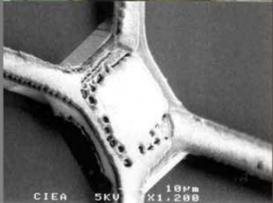
# Microfotografía de sensor CMOS



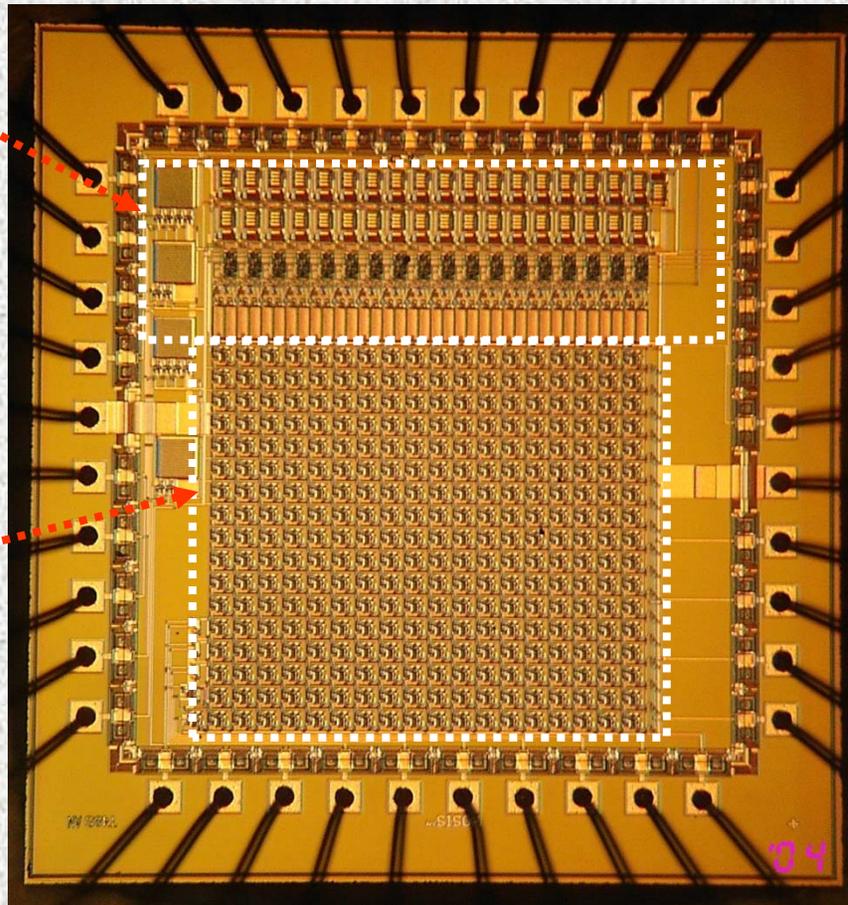
Bloque de proceso analógico del centroide



Matriz fotodetectora

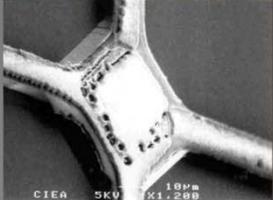
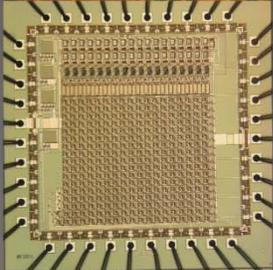
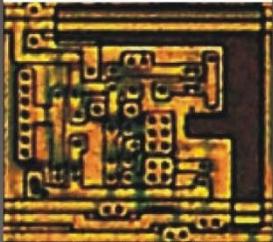


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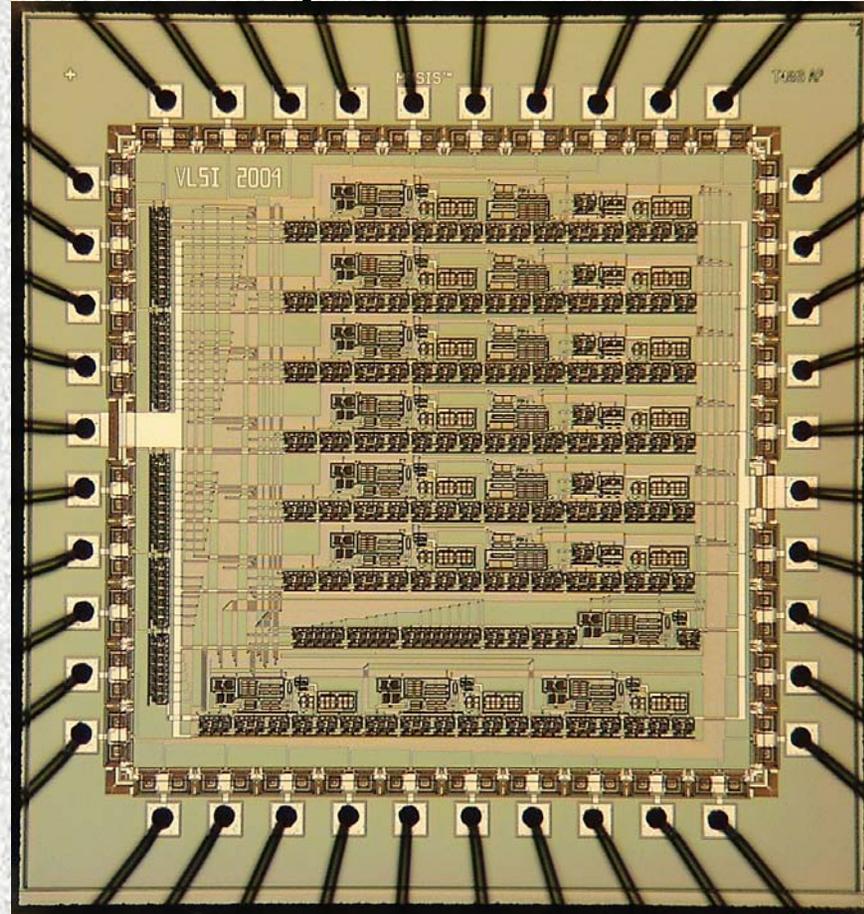
**SISTEMAS VLSI**

# Microfotografía de Red Neuronal Adaptable

A) Algoritmo LMS

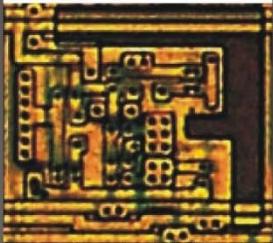
B) Proceso no lineal basado en polinomio de segundo orden de dos variables

C) Tarea: predicción





# Microfotografía de Red Neuronal Celular (CNN)



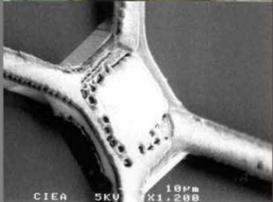
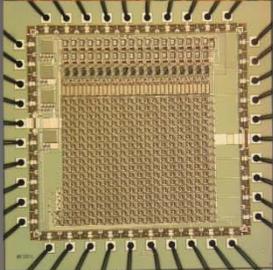
Matriz CNN 4x4 .

Tareas:

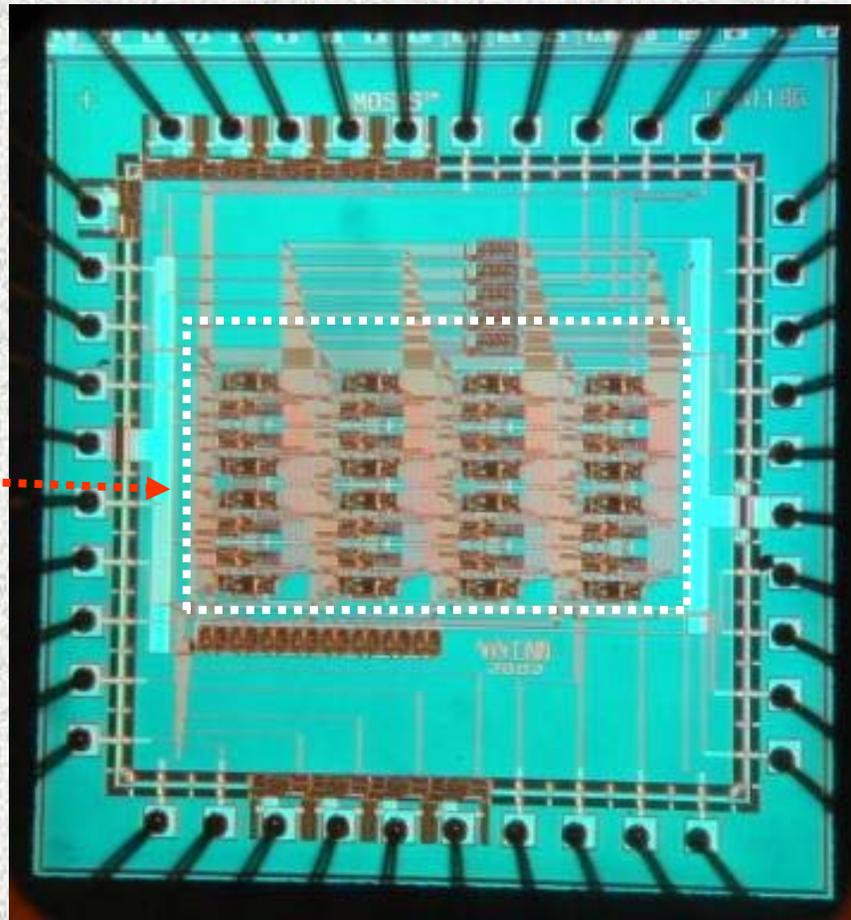
A) Detección de bordes en tiempo real (200ns)

B ) Detección de componentes conectados

Tecnología de transistor de compuerta flotante

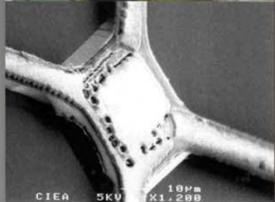
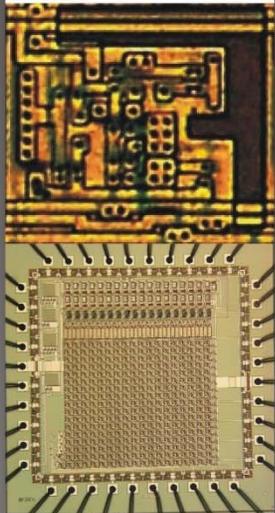
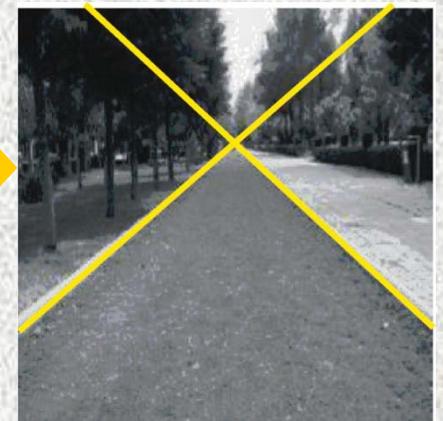
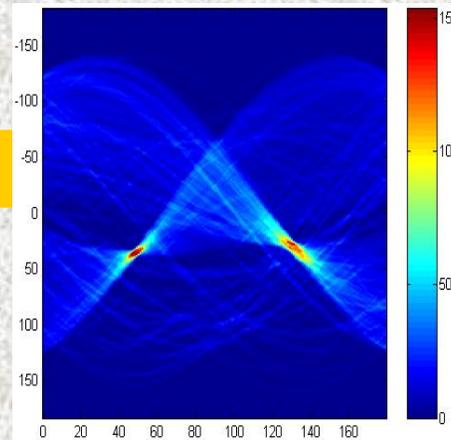
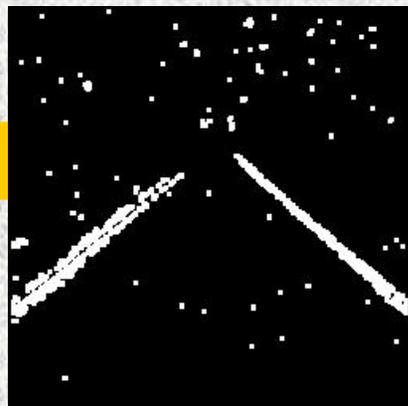
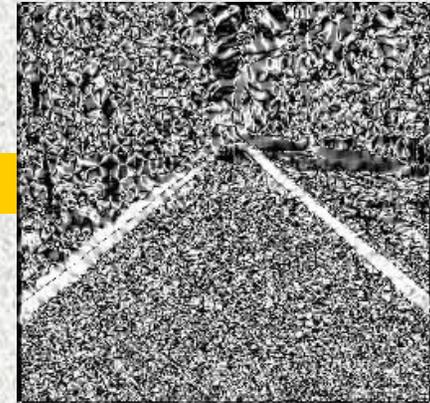
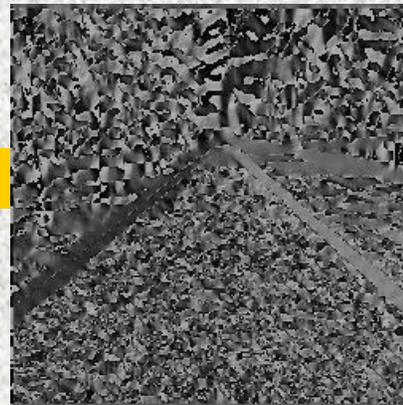


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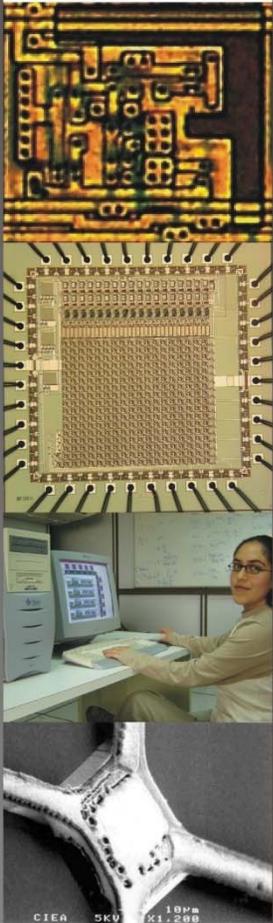
# Procesamiento Difuso de Imagen (Detección de Bordes para Navegación Autónoma)



**SISTEMAS VLSI**

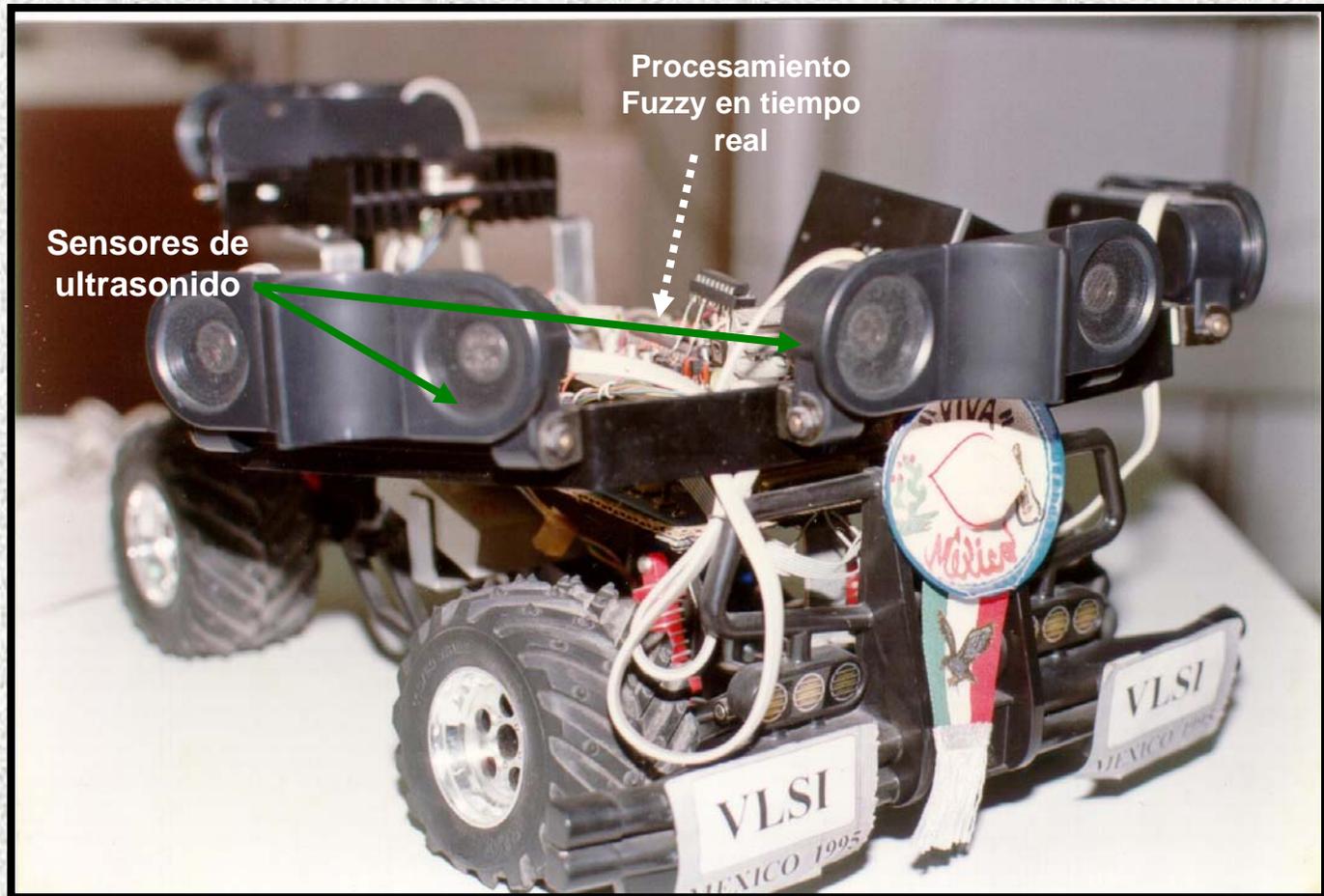


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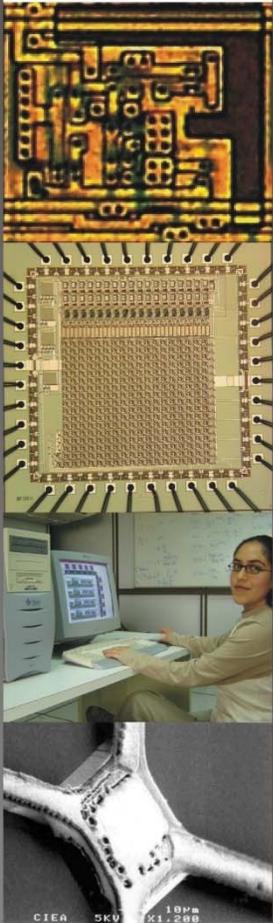
**SISTEMAS VLSI**

# Prototipo de vehículo de navegación autónoma V1.0

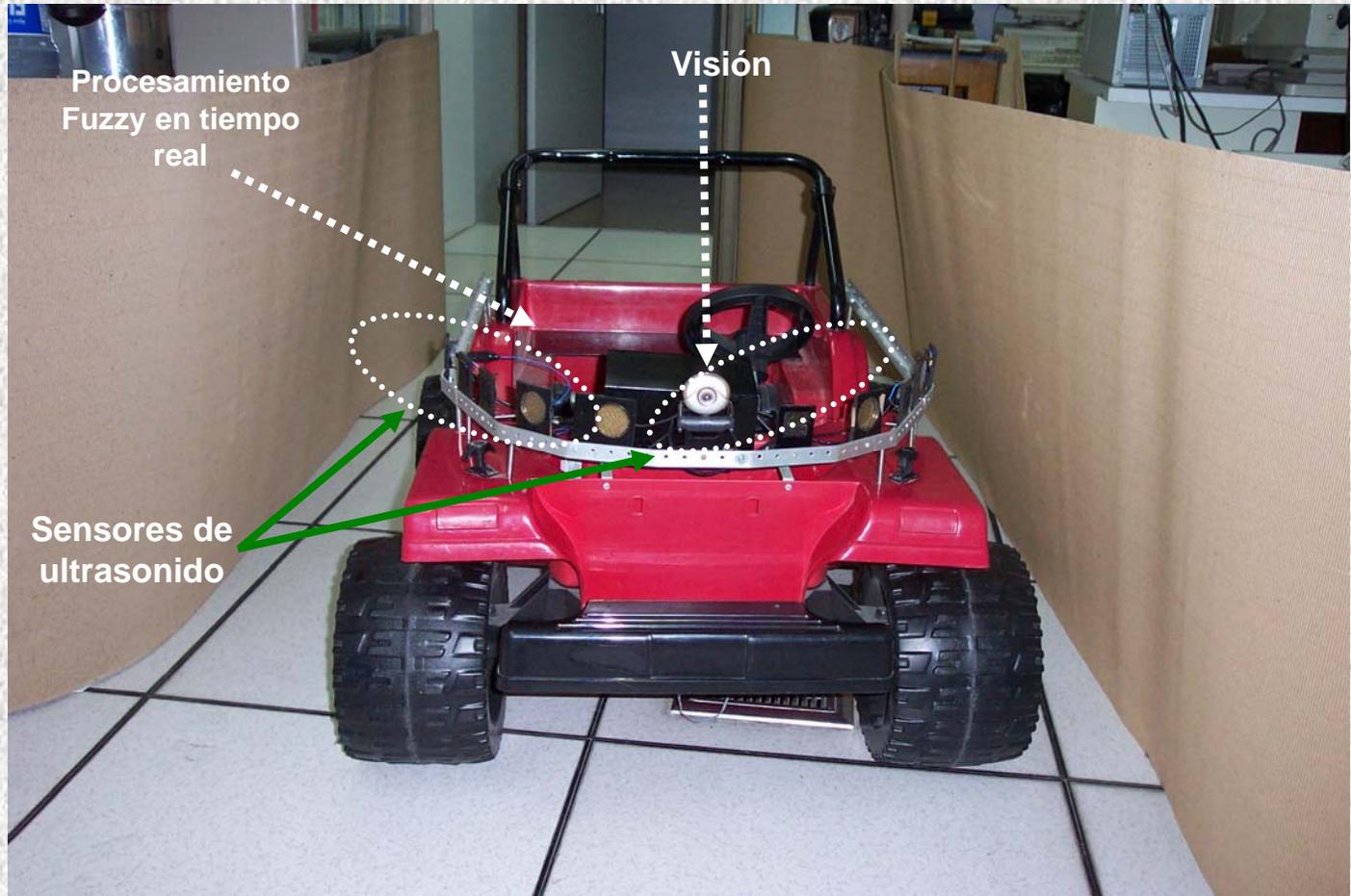




# Prototipo de vehículo de navegación autónoma V2.0

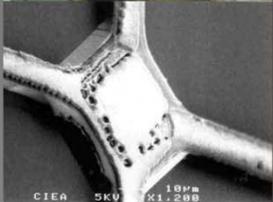
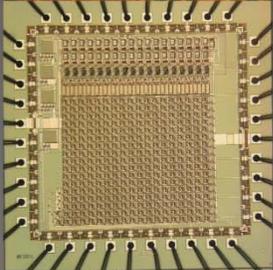
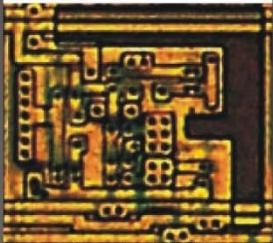


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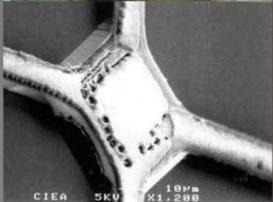
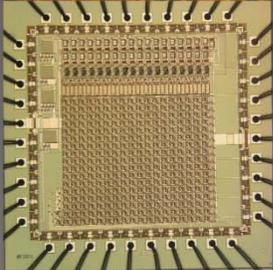
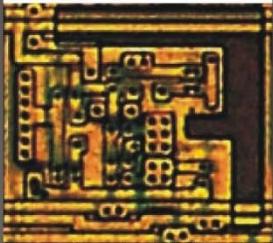
Robot autónomo con procesamiento de visión empleando una tarjeta Spartan 3E

Robot autónomo con procesamiento de imagen empleando la tarjeta de evaluación Spartan 3E de FPGAs de Xilinx





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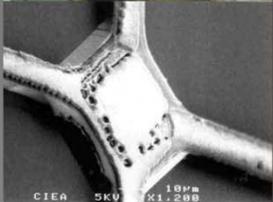
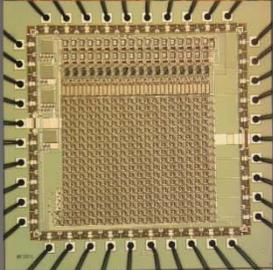
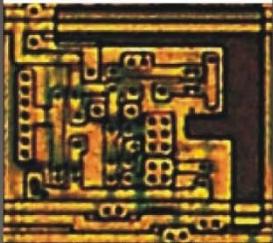
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## Sistema de análisis de señales basado en teoría de componentes principales y con estructura de red neuronal artificial



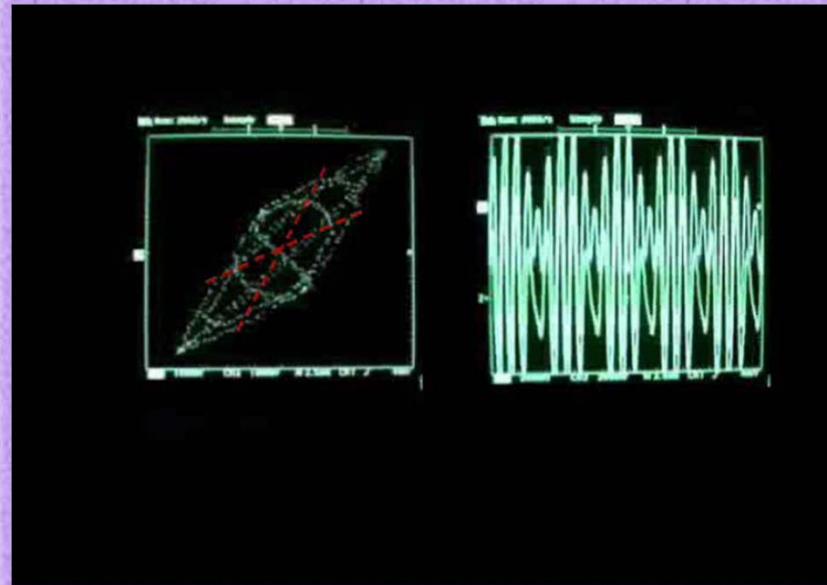
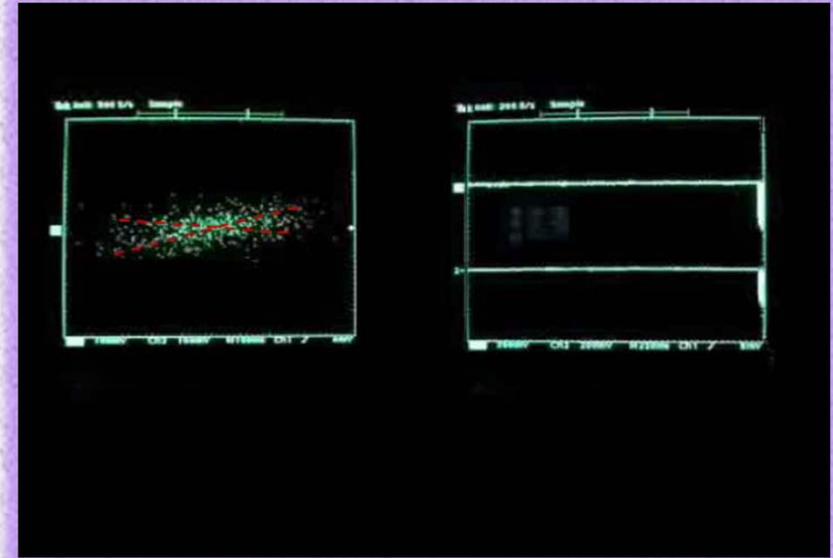


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Separación de  
señales de  
audio

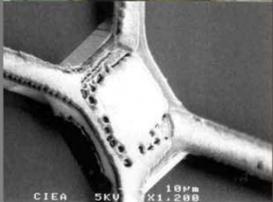
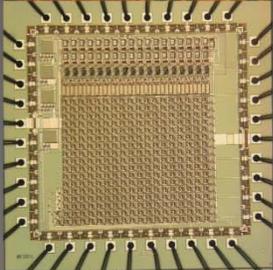
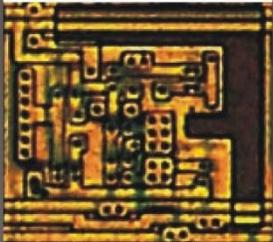


Separación de  
señales  
senoidales





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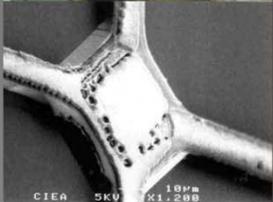
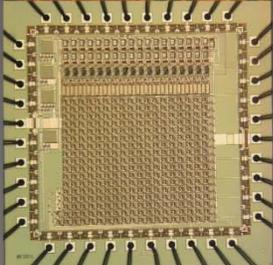
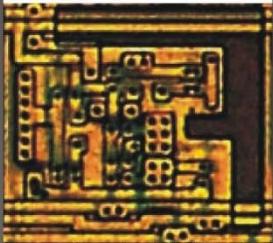
## Algunos ejemplos de Sistemas Micro-Electro-Mecánicos (MEMS)



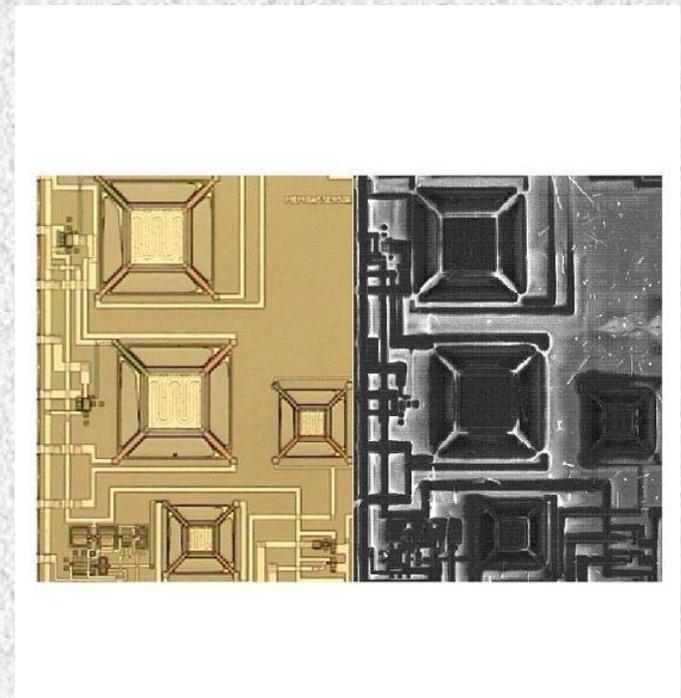
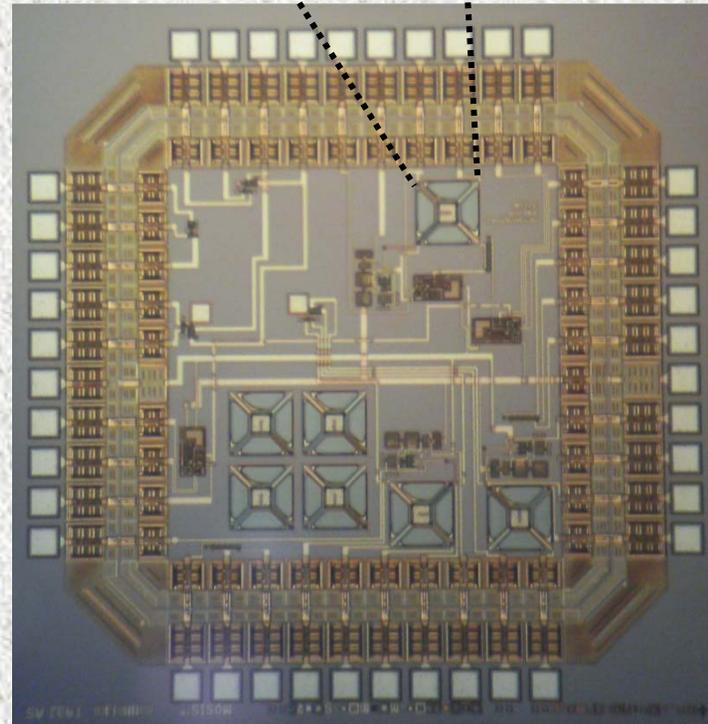
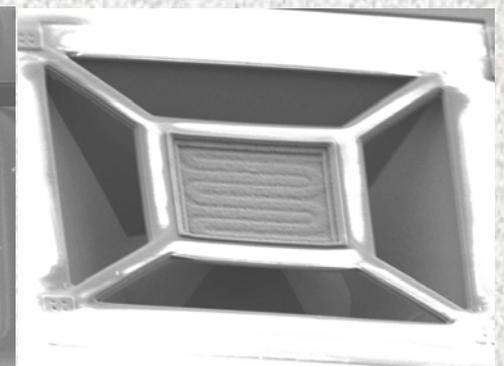
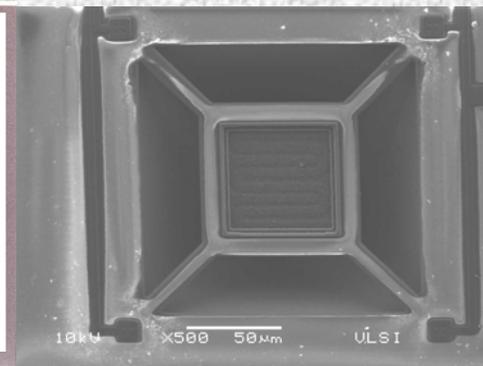
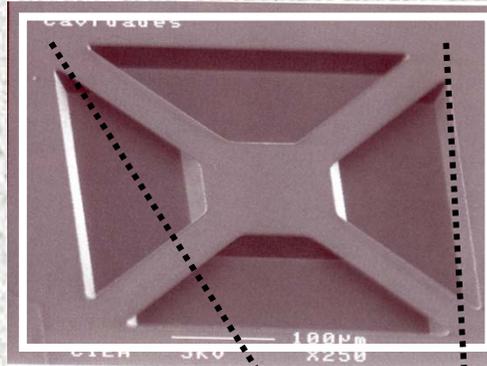


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# Microfotografía (SEM) de Grabado de Fosos

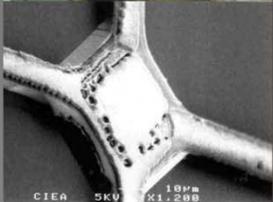
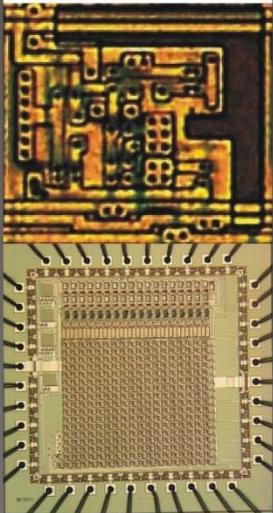


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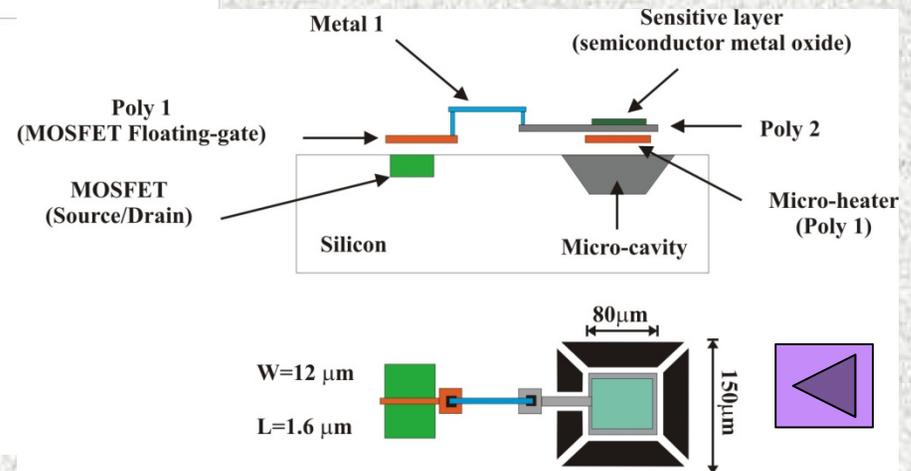
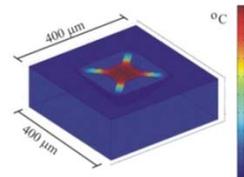
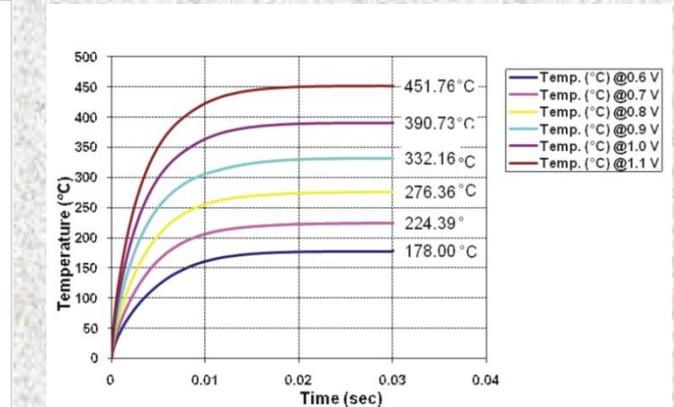
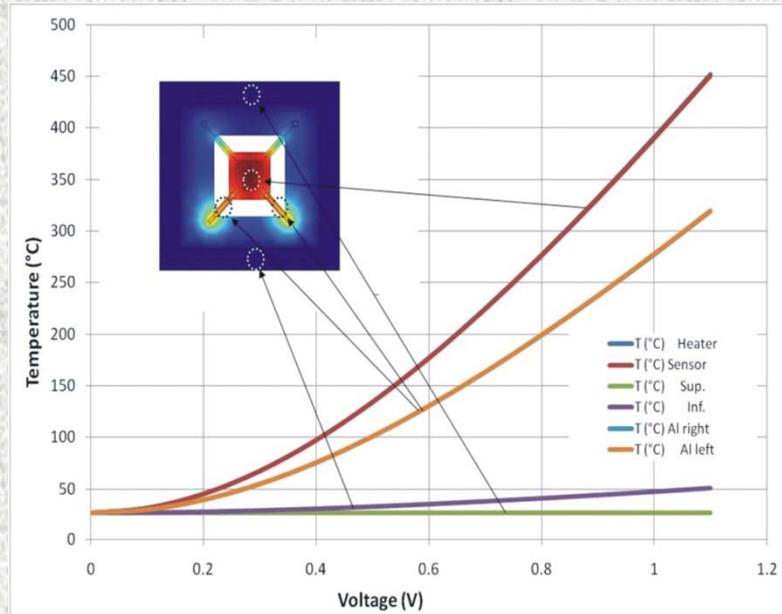




# Simulación electro-térmica y diagrama esquemático del sensor

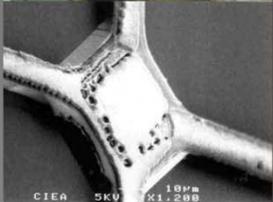
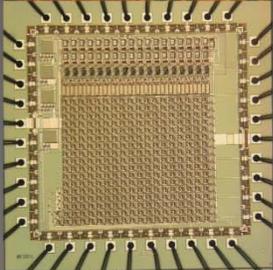
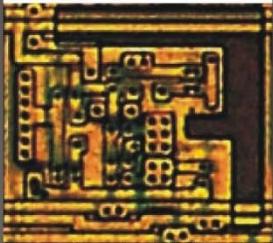


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CIEA 5KV X1.200 10µm

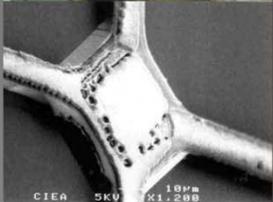
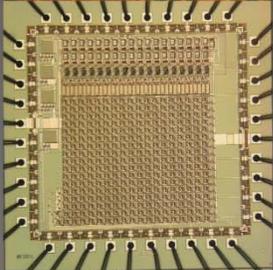
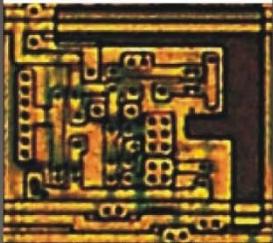
**SISTEMAS VLSI**

## Modelación de biopilas mediante sistemas neurodifusos



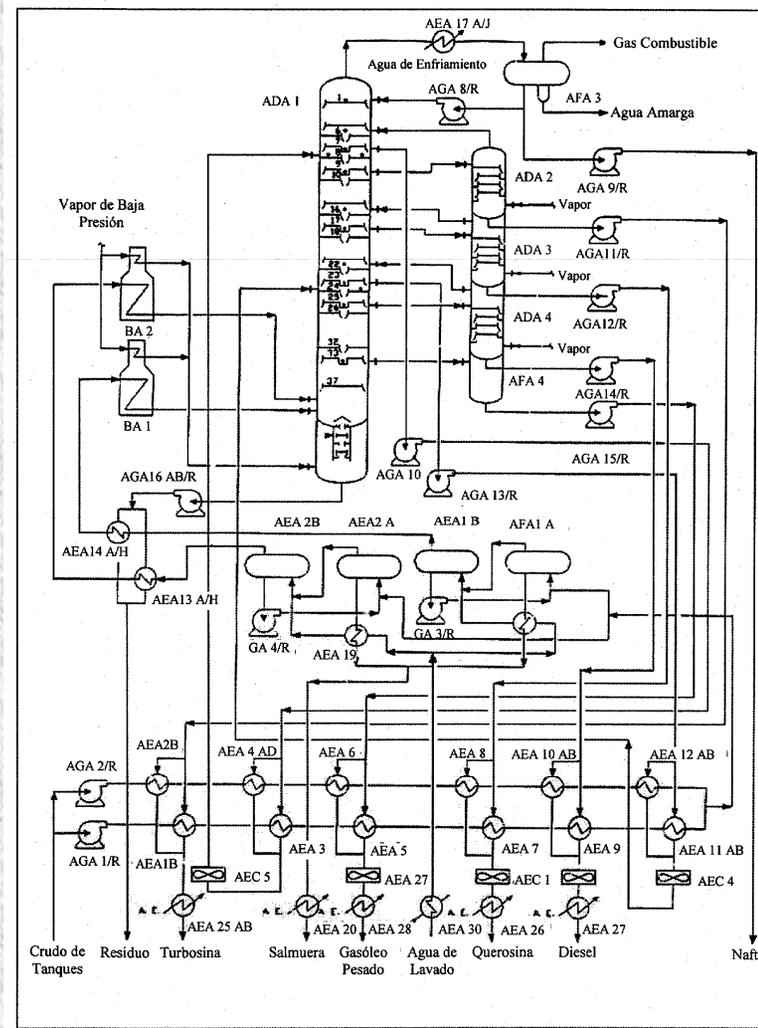


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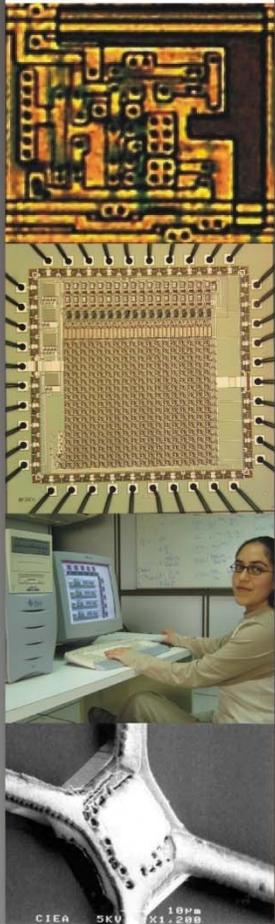
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# Unidad de Destilación Atmosférica de Crudo

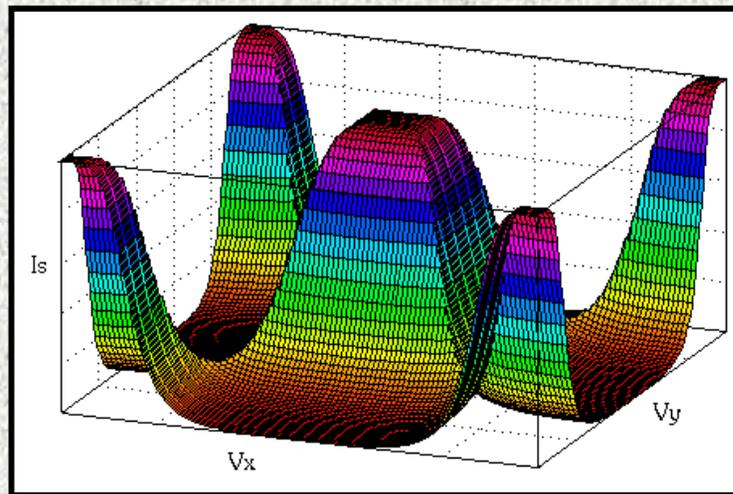
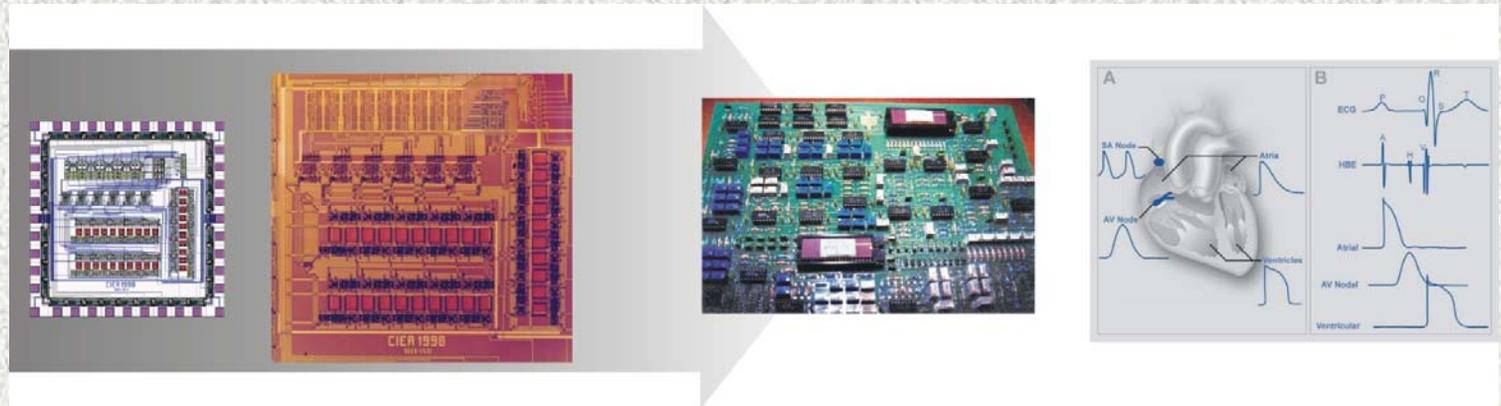




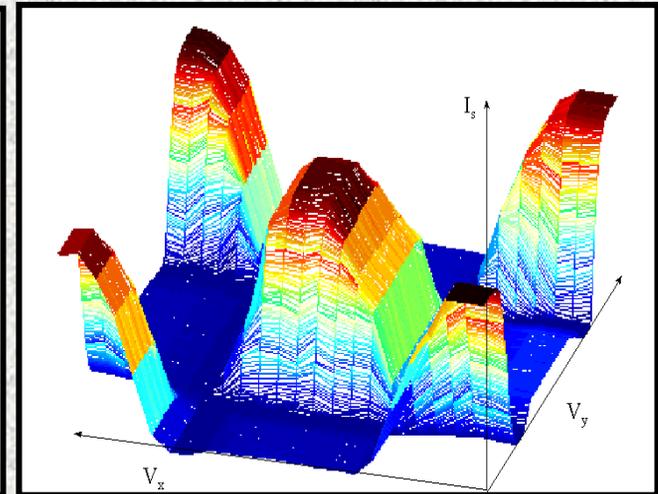
# Sistema de Detección de Contracción Ventricular Prematura (PVC) Basado en Redes Neurodifusas



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**Resultados  
teóricos**



**Resultados  
experimentales**

