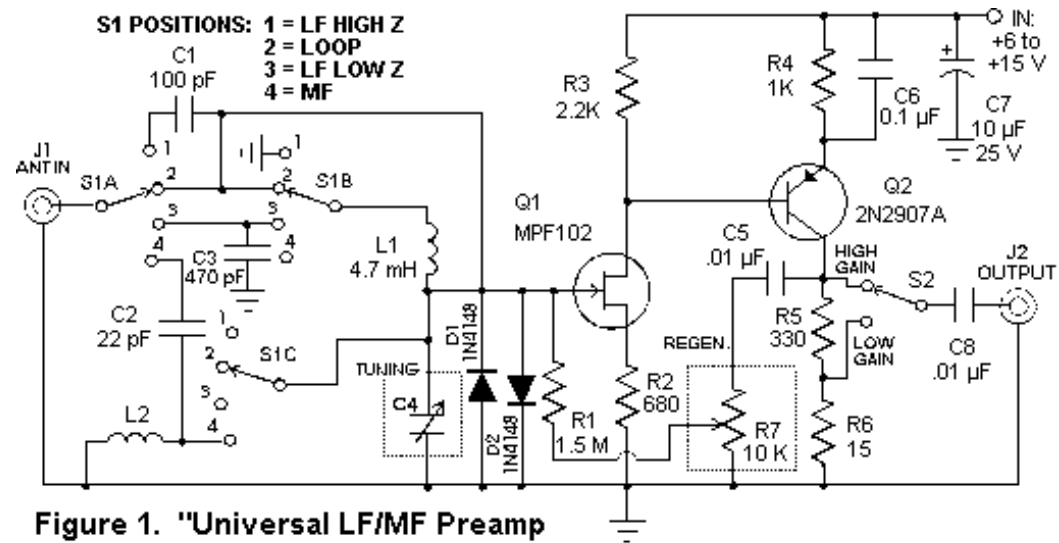


# Circuit Simulation

## Background Demo

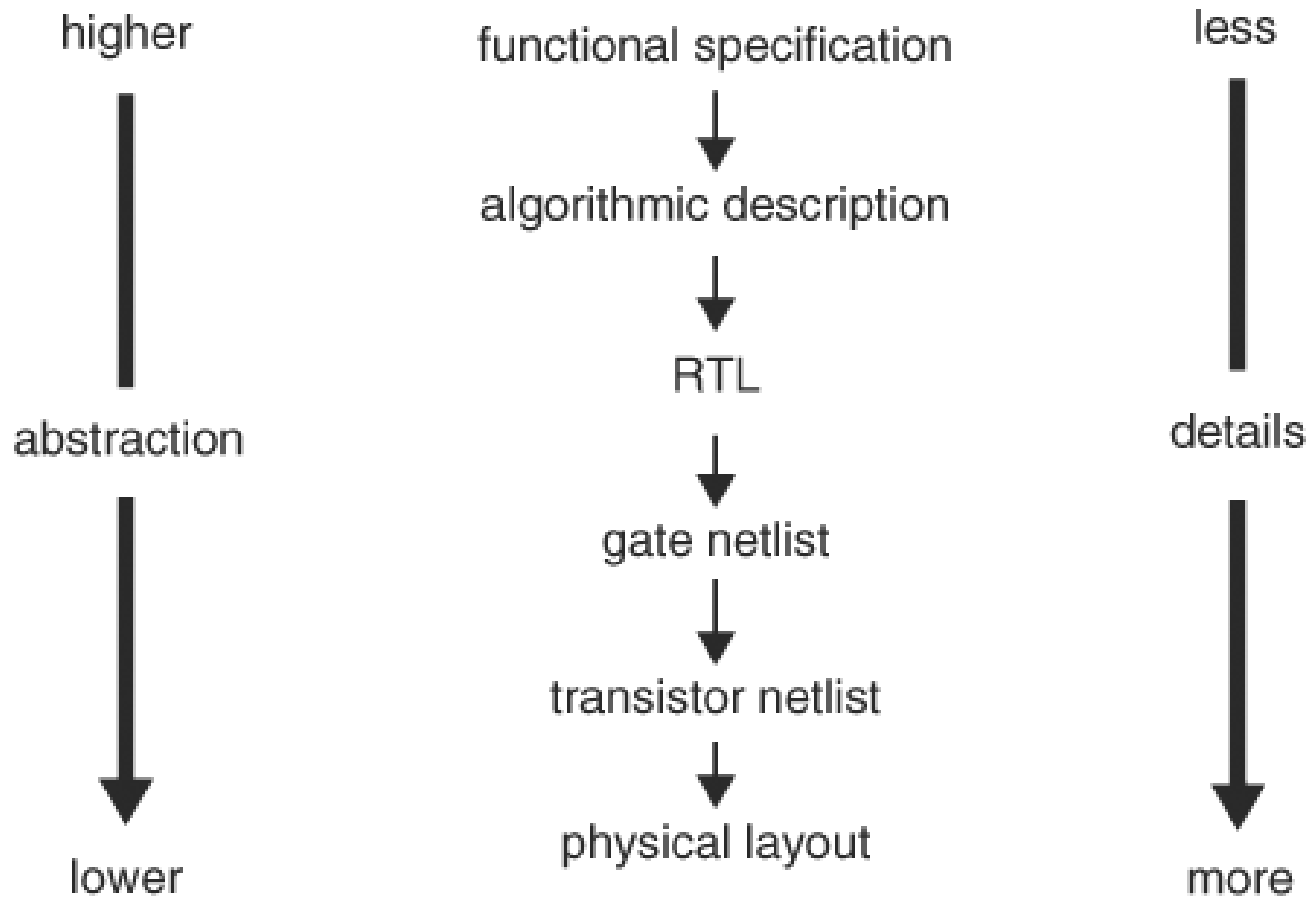


Rick Miller - AB8ON



# Simulation

## design flow





# Algorithm Example - VHDL

```
-- VHDL code for n-bit adder
--
-- A plus B to get n-bit sum and 1 bit carry
-- we may use generic statement to set the parameter
-- n of the adder.
```

---

entity ADDER is

```
    generic(n: natural :=2);
```

```
    port(    A:          in std_logic_vector(n-1 downto 0);
           B:          in std_logic_vector(n-1 downto 0);
           carry:      out std_logic;
           sum:        out std_logic_vector(n-1 downto 0)
    );
```

end ADDER;

---

architecture behv of ADDER is

```
-- define a temporary signal to store the result
```

```
    signal result: std_logic_vector(n downto 0);
```

```
    begin
```

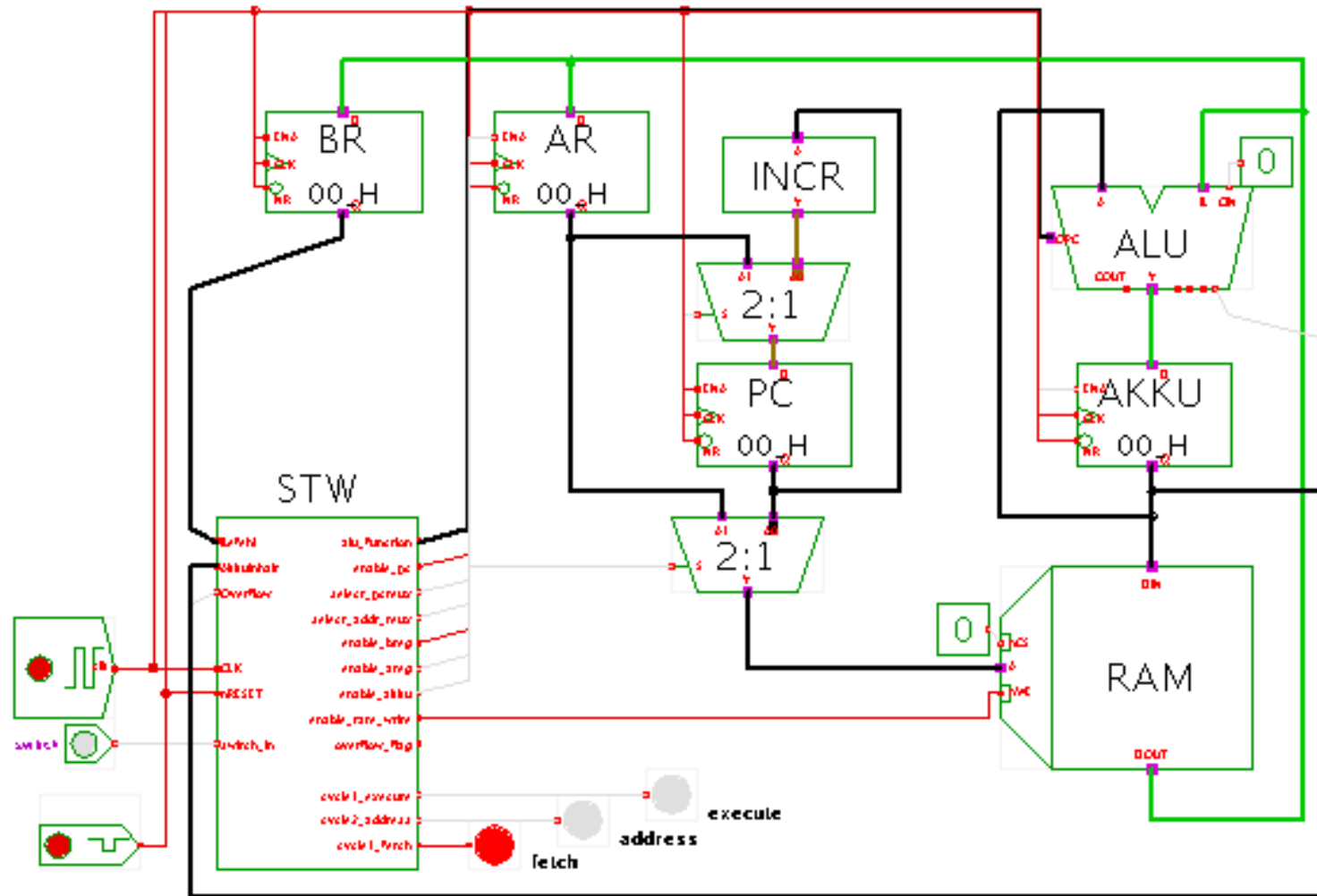
```
-- the 3rd bit should be carry
```

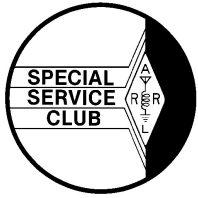
```
    result := ('0' & A) + ('0' & B);
    sum := result (n-1 downto 0);
    carry := result( n );
```

end behv;



# RTL





# Gate Netlist

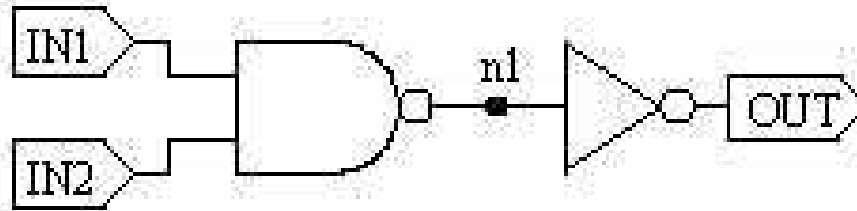
- **\*file: and2.sp**

```
.model n nmos
```

```
.model p pmos
```

```
Vvdd vdd 0 5
```

```
Vgnd gnd 0 0
```



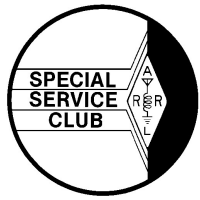
```
.include nand2.sp
```

```
.include inv.sp
```

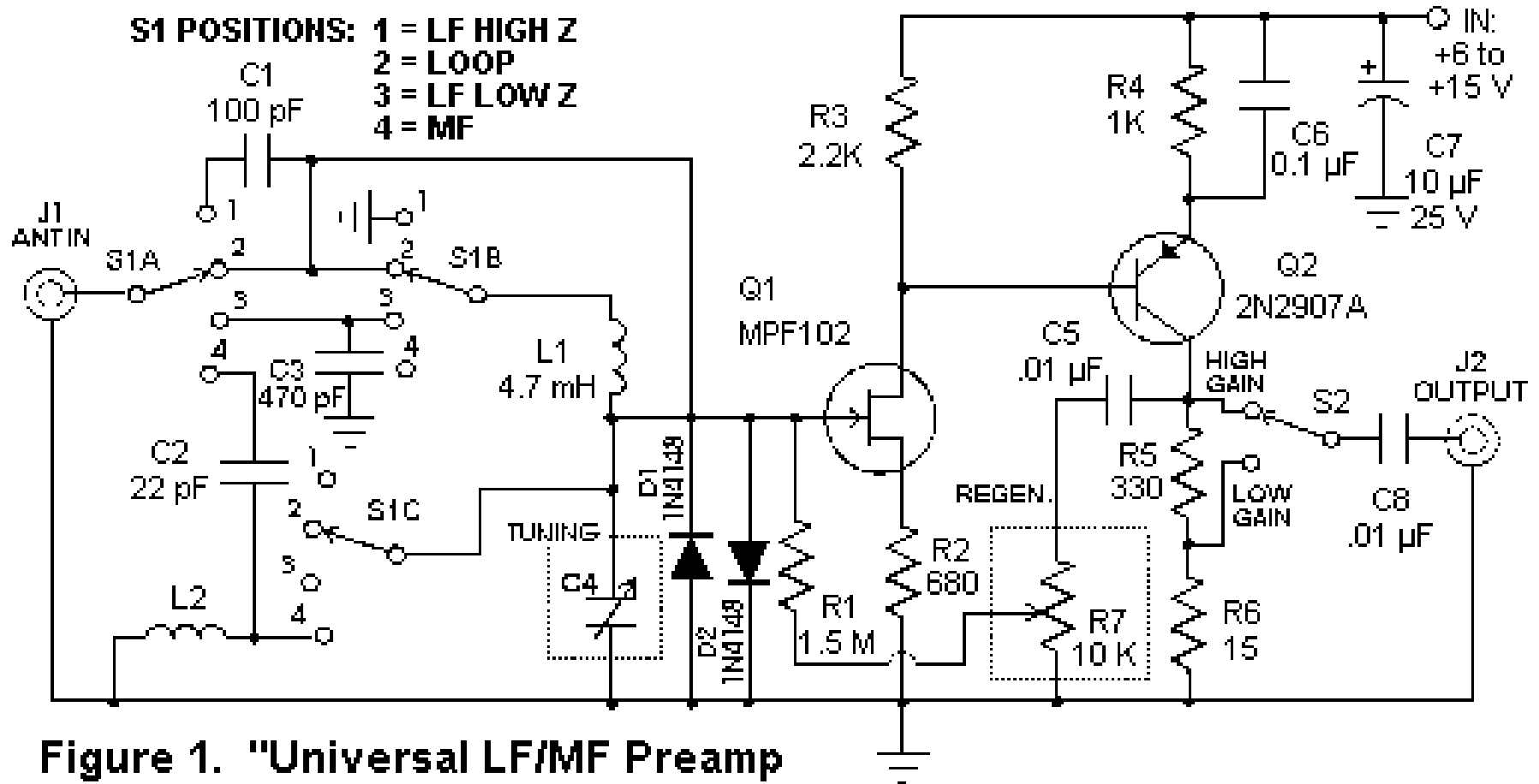
```
xnand2_1 IN1 IN2 n1 vdd gnd nand2
```

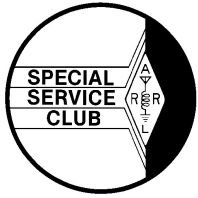
```
xinv_1 n1 OUT vdd gnd inv
```

```
.end
```

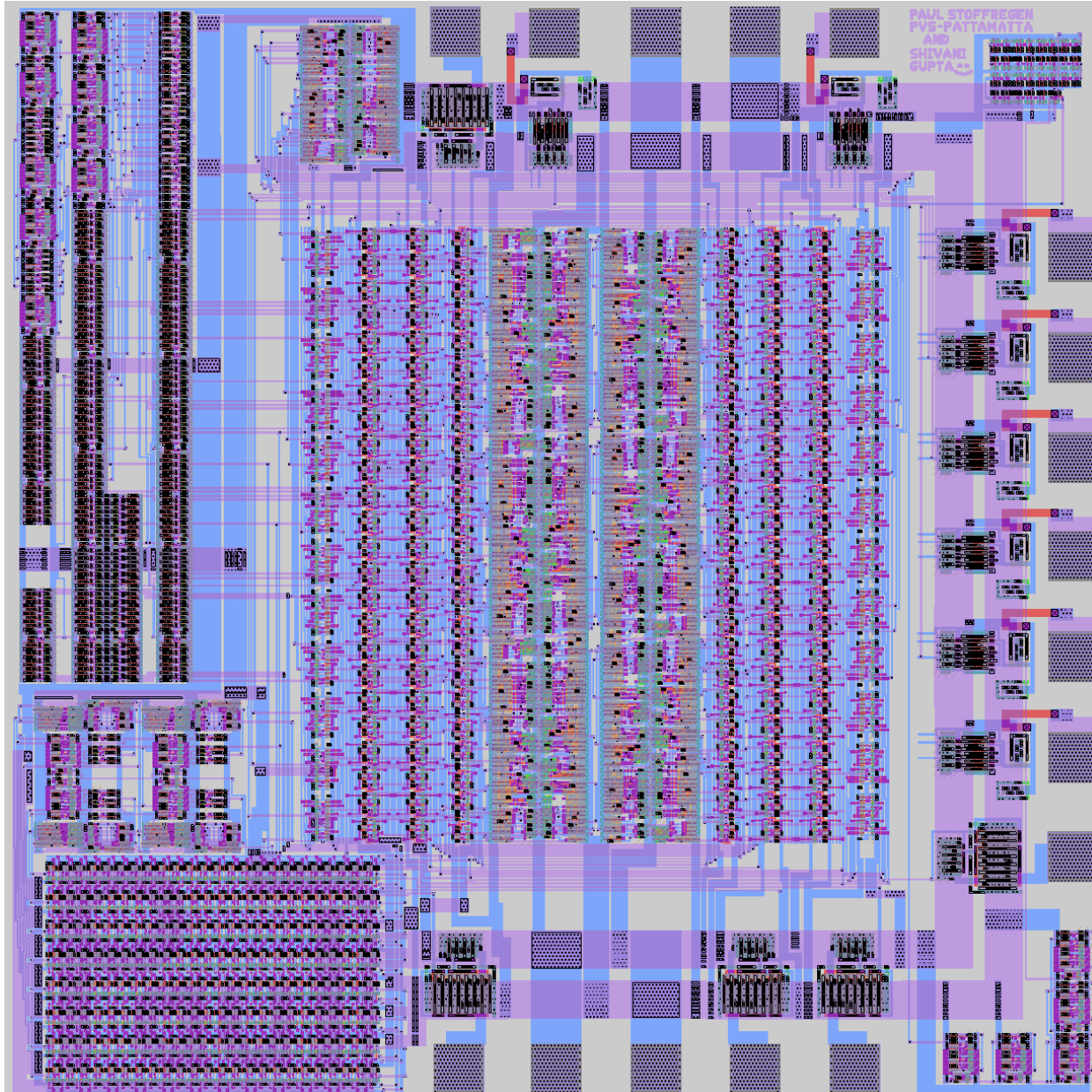


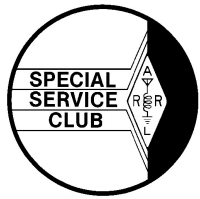
# Transistors





# Physical Layout





## Big Business

Company	Location	Market Value (12/2005)	Logo
Cadence Design Systems	San Jose, California	\$5.17 billion	The logo for Cadence Design Systems, featuring the word 'cadence' in a lowercase, sans-serif font with a red accent over the 'a', enclosed in a black rectangular border.
Synopsys	Mountain View, California	\$2.95 billion	The logo for Synopsys, featuring the word 'SYNOPSYS' in a bold, blue, sans-serif font.
Mentor Graphics	Wilsonville, Oregon	\$729 million	The logo for Mentor Graphics, featuring the word 'Mentor' in red and 'Graphics' in black, both in a sans-serif font.
Magma Design Automation Inc	Santa Clara, California	\$302 million	The logo for Magma Design Automation, featuring the word 'MAGMA' in a bold, black, sans-serif font with three red vertical bars above the 'M'.
Zuken Inc.	Yokohama, Japan	\$300 million	The logo for Zuken, featuring a stylized blue and yellow square icon followed by the word 'ZUKEN' in a bold, blue, sans-serif font.

Source: [http://en.wikipedia.org/wiki/Electronic\\_Design\\_Automation](http://en.wikipedia.org/wiki/Electronic_Design_Automation)



# Simulation Software for Hams

- **Analog Circuit Simulator Applet – educational**
  - <http://www.falstad.com/mathphysics.html>
- **SPICE – for serious hobbyists**
  - History
    - <http://en.wikipedia.org/wiki/SPICE>
  - Installable Executable
    - <http://www.linear.com/designtools/softwareRegistration.jsp>
  - Source-Only
    - <http://tclspice.sourceforge.net/#features>
    - <http://ngspice.sourceforge.net/index.html>