where $[N]_r$ is the radix complement and n is the number of digits in the integer portion of the number $(N)_r$.

This system is commonly called either *twos complement* or *tens complement*, depending on which number system is used. This section will describe the twos complement system. Because the tens complement system displays the same characteristics as the twos complement system, it will not be discussed here.

Example 1.32

(a) The twos complement of $(01010)_2$ is

$$2^5 - (01010) = 100000 - 01010 = 10110$$

Here $n = 5$ and $r = 2$.

(b) The twos complement of $(0.0010)_2$ is

$$2^1 - (0.0010) = 10.0000 - 0.0010 = 1.1110$$

Here, $n = 0$ and $r = 2$.

(c) The tens complement of $(4887)_{10}$ is

$$10^4 - 4887 = 5113$$

Here, $n = 4$ and $r = 10$.

(d) The tens complement of $(48.87)_{10}$ is

$$10^2 - 48.87 = 51.13$$

Here, $n = 2$ and $r = 10$.

As can be verified by Example 1.32, there are two other methods for obtaining the radix complement of a number.

METHOD 1

$[01010]_2 = ?$

$$\begin{array}{r} 10101 \\ +\ 1 \\ \hline 10110 \end{array}$$

a. Complement each bit (i.e., change each 0 to 1 and 1 to 0).

b. Add 1 to the LSB to get the twos complement.

METHOD 2

$[010|10]_2 = ?$

$$\begin{array}{r|l} & 10 \\ 101 & \\ \hline 101 & 10 \end{array}$$

a. Copy the bits from the LSB until and including the first nonzero bit.

b. Complement the remaining bits through the MSB to get the twos complement.

The *diminished radix complement* $[N]_{r-1}$ of a number $(N)_r$ is defined as:

$$[N]_{r-1} = r^n - r^{-m} - (N)_r \qquad (1.4)$$

where n and m are respectively the number of digits in integer and fraction portion of the number. Note that

$$[N]_r = [N]_{r-1} + r^{-m} \qquad (1.5)$$

That is, the radix complement of a number is obtained by adding a 1 to the LSB of the diminished radix complement form of the number.

The diminished radix complement is commonly called the *ones complement* or *nines complement*, depending on which number system is used.

Example 1.33

$(N)_r$	r	n	m	$[N]_{r-1}$
(a) 1001	2	4	0	$2^4 - 2^0 - 1001$
				$= 10000 - 1 - 1001$
				$= 1111 - 1001 = 0110$
(b) 100.1	2	3	1	$= 2^3 - 2^{-1} - 100.1$
				$= 1000 - 0.1 = 100.1$
				$= 111.1 - 100.1 = 011.0$