

Answer on Question #57532 – Math - Trigonometry

Question

State of the system at any given time is determined by a set of values of n parameters. Each parameter can take one of three values: 1, 0, -1. It is known that the parameter value is defined by formula $A_1 = \sin(A_2 * A_3 \dots A_n * \pi / 2)$. How many different states of the system?

Solution

Find the possible states of the system for $n=1$:

$$A_1 = \sin\left(\frac{\pi}{2}\right) = 1$$

The system has 1 possible state.

Find the possible states of the system for $n=2$:

$$A_1 = \sin\left(A_2 * \frac{\pi}{2}\right) = \begin{cases} -1, & \text{if } A_2 = -1 \\ 0, & \text{if } A_2 = 0 \\ 1, & \text{if } A_2 = 1 \end{cases} \Leftrightarrow A_1 = A_2$$

The system has 3 possible states.

Find the possible states of the system for $n=3$:

$$A_1 = \sin\left(A_2 * A_3 * \frac{\pi}{2}\right) = \begin{cases} -1, & \text{if } A_2 * A_3 = -1 \\ 0, & \text{if } A_2 * A_3 = 0 \\ 1, & \text{if } A_2 * A_3 = 1 \end{cases} \Leftrightarrow A_1 = A_2 * A_3$$

The system has 9 possible states.

Find the possible states of the system for any n :

$$A_1 = A_2 * A_3 * \dots * A_n$$

The system has 3^{n-1} possible states.

Answer: 3^{n-1} different states of the system.