

## **Effect of Angle Orientation of Flat Mirror Concentrator on Solar Panel System Output**

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**Abstract:** *In this research two flat glass mirrors is used as concentrator of solar panel system. The mirrors increase's the concentration of sun light ray on the solar module. Anew model of solar panel system is designed by mean of software Zemax in order to find best possible inclination angle of the concentrator that improves the performance of the solar panel. So the efficiency is 59.5% for designed system with inclination angle 60° of the concentrator. Then a practical design for the solar panel system with concentrators is established. The outdoor measurements for the practical design indicated that the output power and efficiency is increasing by increasing the inclination angle of the concentrator and reaches its maximum value at 60° at different times of the date 5-2-2014. Also the results showed that the maximum value of efficiency is 0.85 at 11 o'clock at 60°. While the maximum value of the output power is 72.8w at 12 o'clock of the same day.*

**Keywords:** *solar panel, concentrators, flat mirror concentrator.*

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### **I. Introduction**

The need for energy from renewable sources has become a pressing issue in recent years. Renewable energy is the essential development for the secure future. Among various natural resources, solar energy is a radiant energy that produced by the sun. The solar energy that is incident on the earth surface can be converted directly to electricity by photovoltaic (PV) or into thermal energy by solar collectors.

A PV module consists of individual solar cells electrically connected together to increase their power output. They are packaged so that they are protected from the environment and so that the user is protected from electrical shock. However, several aspects of PV module design which may reduce either the power output of the module or its lifetime need to be identified. A final structural component of the module is the edging or framing of the module. A conventional PV module frame is typically made of aluminum. The frame structure should be free of projections which could result in the lodgment of water, dust or other matter [1].

The using of solar energy in Iraq faces real problems which indicated as accumulation of dust on solar panels and the high ambient temperatures. The accumulation comes from the increasing of activity of dust storm after the year of 2000 due to the global climate change, enlarging the desertification and the shortage in water resources. The input optical power, that reaches to the solar cells, decrease with period time and reached to about 50% for one month under the effect of natural deposition of dust [1].

Over the last few decades, there has been an increasing effort from governments, industry and academic institutions to find useful way to improve the solar cell or photovoltaic cell efficiency. One of these ways is concentrator photovoltaic systems, which use a limited number of small, specialized, efficient solar cells and concentrating optics to increase the intensity of sunlight striking the cells such as [2-6].

### **II. Solar Module Characteristic**

A solar Module is a set of solar cells connected in series. Solar panels are referred to by the industry as solar cell modules or PV modules. Module or panel is flat arrangement of series connected silicon solar cells. There are generally 30 to 36 solar cells per module. The modules can be wired as series or parallel arrays to produce higher voltage and currents as illustrated in Figure (1).