Abstract.

In this paper, a sun tracking system is designed and built using a simple mechanical structure and control method. A comparison is carried out between a fixed solar system and the tracking system to emphasize the increase in the energy produced. The tracking system reliability is also tested for diverse weather conditions.

Key words
maximum power point, photovoltaic, solar energy, dc drives, renewable energy.

Global warming caused by pollution associated with energy production from depletable sources such as fossil fuels have become an important issue addressed worldwide. Hence a continuous non-depletable source with zero emission must be deployed to protect the environment especially after the Koyoto Protocol. Developed countries have taken the lead in implementing several measures to promote renewable energy generation from continuous sources such as solar, wind, hydropower, biological and Geothermal processes.

The selection of the renewable source depends highly on the location however considerations must also be taken regarding the efficiency and cost. Independently of the source chosen, the sun is actually the basic of all renewable sources since all other forms are directly or indirectly related to the sun itself. Solar energy can be harnessed to generate power using one of two mechanisms: thermal and electrical. In the thermal process the sun's radiation heats up a liquid to produce steam which drives generators. The other topology utilizes the concept of directly producing electricity from solar radiations. In this paper the latter is discussed, however the implemented method is definitely suitable for the other method too.

Electricity can be generated from the sun by means of solar (or photovoltaic) cells which pass current when the sun radiation hits its surface. However due to the fact that each cell produce low voltage and low current, the cells are connected in series and parallel combinations to produce higher voltages and currents. This combination of cells constitutes a solar module or a solar array. Moreover the solar cell type is classified according to the material used in the fabrication process. Thus the efficiency of solar cells varies from 8% to 20%. The arrays can also be connected in series and parallel combinations to meet the voltage and current requirement of the desired system. This system could be either a stand alone or a grid connected one.

In either case, the performance of such a system must be maximized to produce the highest power out of the solar system. One way of ensuring this is to tilt the solar module to the azimuth angle, however this will not generate the ultimate maximum power. A better approach is to track the sun continuously ensuring the system harnesses more sun radiations, therefore generating more power. Such designs are built using single or dual axis tracking models.

This paper introduces a prototype model for a dual axis mechanical tracking system built around but not limited to an 80 watt solar module. The prototype consists of two ac motors, photo sensors, rigid steel structure, and a microcontroller. The microcontroller collects data from the photo sensors to drive the motor that directs the solar module perpendicularly towards the sun radiations.

The model is built and tested under various weather conditions proving its reliability. The system is generating 25% more power compared to the fixed model for a clear sky. The novelty of this design lies in the fact that the system is expandable and rigid with minimum power losses. Moreover, the extra power generated is enough to compensate for the initial cost of the tracking system.