



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Alexander L. Chen	Project Number S0903
Project Title A Maximum Power Point Tracking Circuit with a New Hill Climbing Algorithm	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to determine if a new and simple hill climbing (HC) maximum power point tracking (MPPT) circuit, developed in this project for optimizing the efficiency of the solar panel, could resolve well known deficiencies of popular MPPT circuits based on the conventional HC and perturb-and-observe (P&O) algorithms.</p> <p>Methods/Materials An HC MPPT circuit was designed, constructed, and tested. It consisted of a solar panel, a boost DC-DC converter, an LED load circuit, all home-built, and a microcontroller which hosted a new HC MPPT algorithm. In this algorithm, the microcontroller measured the solar panel output power at five switching duty cycle settings of the DC-DC converter for each perturbation cycle, and then dwelled at the duty cycle which resulted in the highest power. This optimal duty cycle was then used as the midpoint for the next set of perturbations. This process repeats over and over again to allow the solar panel to operate at its maximum power point.</p> <p>Results The MPPT circuit achieved >98% of electrical power that could be achieved by manually setting the switching duty cycle of the DC-DC converter to its optimal value. It showed fast and robust maximum power point tracking under rapidly changing irradiance conditions and was insensitive to voltage ripples caused by the switching circuit.</p> <p>Conclusions/Discussion The MPPT circuit of this project demonstrated fast, robust, and efficient maximum power point tracking capability with a new yet simple HC algorithm without resorting to complicated mathematics or logics.</p>	
Summary Statement A maximum power point tracking circuit and a new hill climbing algorithm with fast and robust tracking capability was developed and demonstrated.	
Help Received Dr. Yaochung Chen provided guidance on circuit design and microcontroller programming. Mr. Peter Starodub provided guidance on project planning and progress tracking.	