CORRECTION FACTOR ESTIMATING OF SILICON PIN PHOTODIODE DERIVED FROM OUTDOOR LONGTERM MEASUREMENT

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ABSTRACT

The measuring of solar irradiance by means of a silicon photodiode element in alternation with well-established solar instruments can currently be applied. At present, it may have a feasible exploitation in the field of building applications concerning the solar radiant flux quantifying. There was observed during a long time of testing, that there are some facts whose discrepancies could currently be identified. The most cardinal issue is the cosine error of diode. A small functional prototype integrating silicone photodiode element was proposed and tested in confrontation with existing radiometer type to obtain a response of long-term in-situ measurements. This paper presents an obtained analytical formula for the calculation of correction factor during real monitored climate outdoor conditions. The revised scheme of sensors's circuit and correlated data from long term testing in comparison with commercial pyranometer sensor is presented. Finally, an obtained correction factor derived from measurements with existing type demonstrates its applicability to the field of building science and solar energy.

OBJECTIVE

The object of this study demonstrates an availability and simple use of this type an opto-electric component, presented study analyze a photodiode BPW34 type as a possible substitution of commercial sensors for measuring a solar radiation. During previously measurement were obtained data with difference with reference commercial sensor Fig.1. These differences are time changing during day and in long term period could be seen dependency on date, too. To identify factors having the main influence has been prepared test setup Fig. 2 located at the roof of the research center AdMaS of Brno University of Technology.

METHOD

Sensors uses improved electrical circuit showed by Fig. 3. Data from long time measurement has been confronted and differences between diode and commercial sensors have pointed to angular sensitivity of diode. According to datasheet data has been set relation between positon of the sun and correction factor Fig. 4. Correction factor is set from sun position from knowns equation and applied on measurement data.

ILLUSTRATIONS

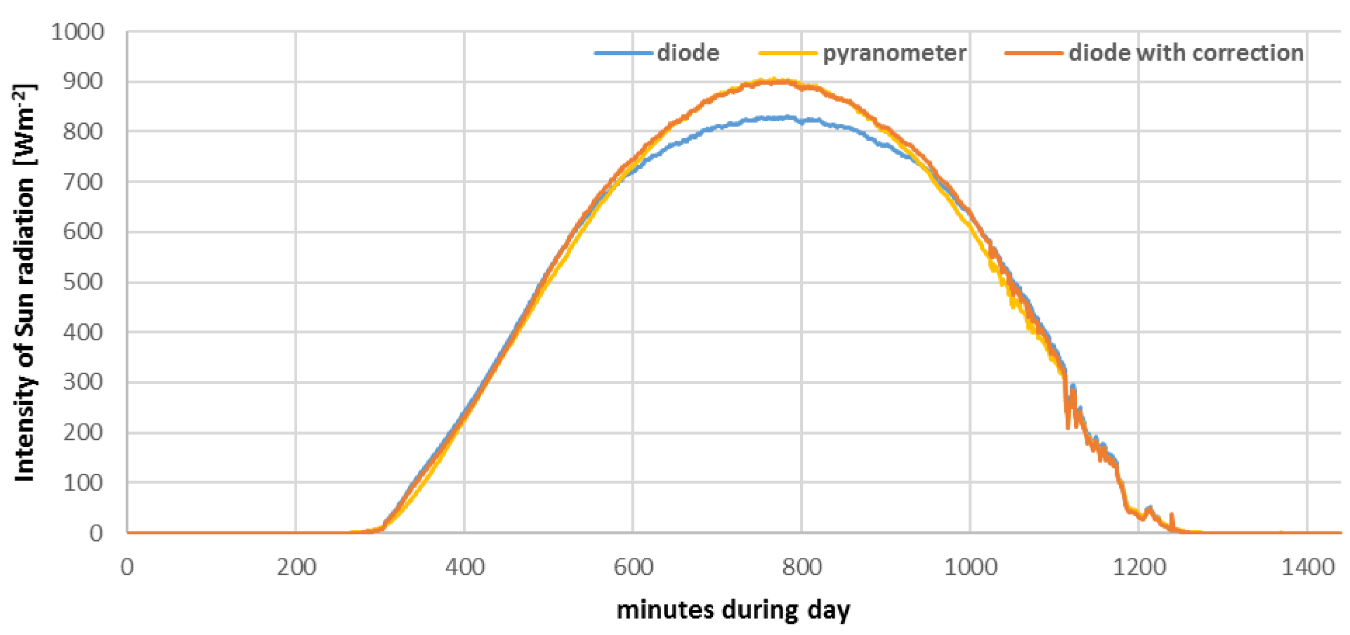

Figure 1: Comparison of measured and corrected data to reference measurement

Figure 2: Experimental setup

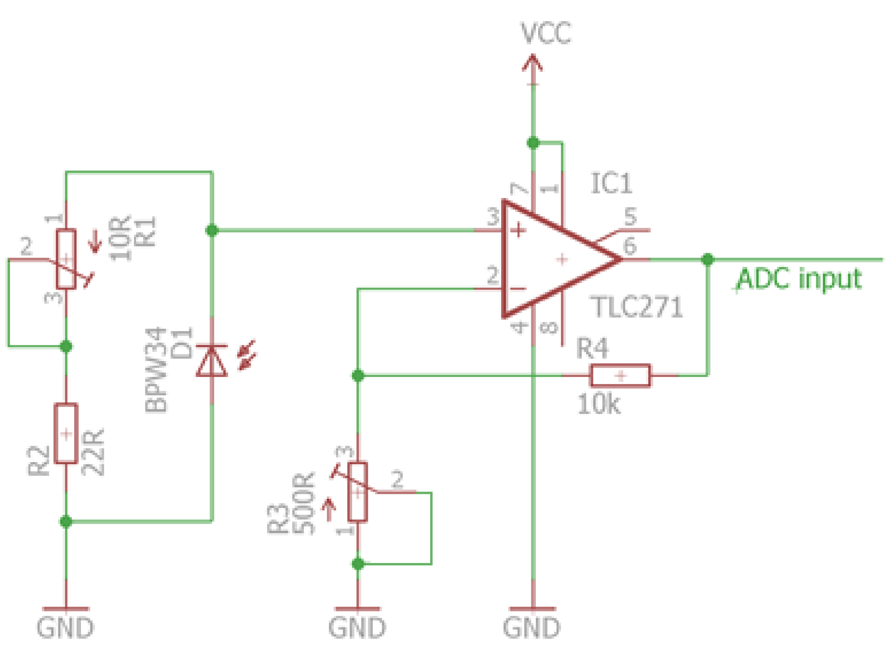

Figure 3: Optimized electrical circuit

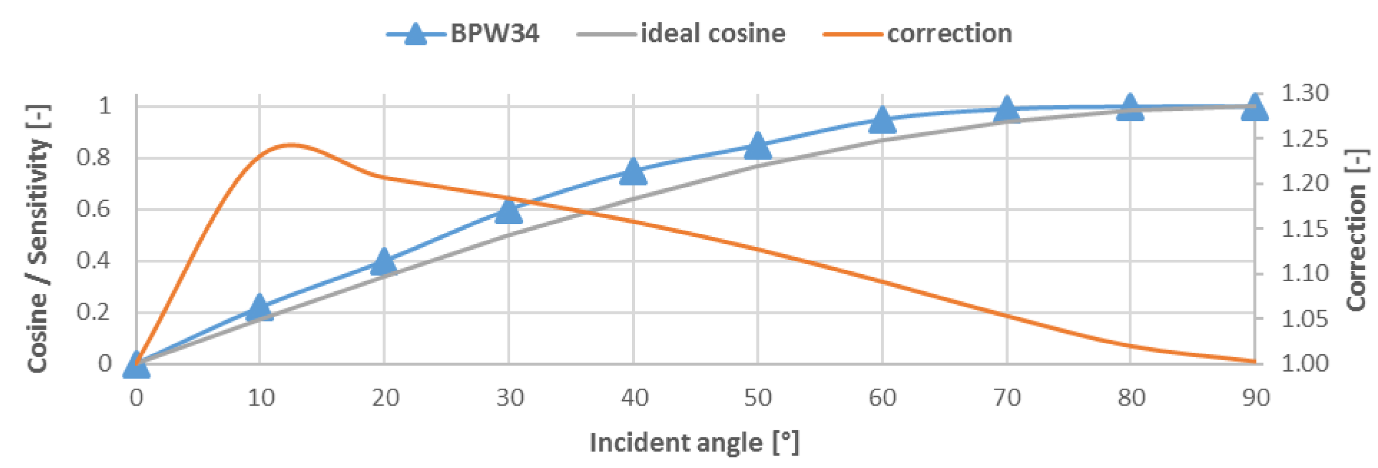

Figure 4: Angular sensitivity and estimated correction factor

CONCLUSIONS

The presented method of correction was applied on measured data whose final result correlation eliminates differences between commercial sensor used as reference and diode prototype as proposed alternation. The diode and its simple circuit may help us find an application in many research projects, where the accuracy about 5% is not so principled. Long time testing and verifying of presented findings should be applied for during whole year monitoring as those of further steps of photo diode implementing in future building applications. Influence of vapor condensation and dirt on diode's surface or temperature dependency of short current should potentially be analyzed during whole year period.

AKNOWLEDGEMENTS

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