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OPTIMAL TRUNCATION CRITERION FOR COMPOUND PARABOLIC COLLECTORS: A THERMODYNAMIC JUSTIFICATION.

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ABSTRACT

The origin of compound parabolic concentrators (CPC) can be traced back to the mid-'60s by the developments of Baranov (USSR), Ploke (Germany), and Winston (USA), who independently described an optical system, unlike traditional systems, based on the optimal transfer of radiation, even if this implies forming aberrations, which allows reaching the thermodynamic limit for solar concentrators.

Today, there is already a wide development of CPCs for solar applications, and several geometries have been generated that take advantage of non-imaging optics to concentrate solar energy on receivers of different shapes (circular, square, triangular, wedge, flat...). One problem with CPCs is that the ratio of height vs. area of the receiver (slenderness) is too large, i.e. these concentrators are too high, and this ultimately limits their application. For several years, different truncation criteria have been proposed to decrease the total height, although all have been developed from a purely geometrical perspective. However, it is possible to derive one of them from a thermodynamic perspective, which allows us to call it an optimal truncation criterion.

Keywords: CPC, truncation, optimization, thermodynamic limit, solar energy

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