Solar-Powered Optics: Insight into a Renewable Energy Resource

Lamas-Nino, Andrea

Budi, Giovanni

Solar energy has been harnessed in a number of ways; one interesting example is in concentrated solar power systems, which harness thermal power of solar radiation to produce electricity. However, even most highest performing systems operate with less than 50% efficiency. Concentrated solar power systems typically use parabolic troughs which reflect incident light to focus onto a tube of fluid. As thermal radiation needs to reach the focus of the parabola without dissipation, it is important to build systems with minimal material and with the focus close enough to the curve such that thermal radiation does not dissipate. Using quadratics and calculus to analyze the parabolas, it is possible to find the quadratic coefficients and curve lengths such that the energy to cost ratio is minimized, and these mathematical findings are confirmed through physical testing. Yet, parabolas with minimized coefficients still face compromises when it comes to real-world implementation, which, along with deeper modeling, is the focus of the future directions of the project.

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