Collecting and Redirecting Sunlight To Maximize Heat Collection in Manufacturing on Solar Farms

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Abstract

Goals:

- to compute maximum attainable temperature to guide the feasibility of such application for high heat manufacturing processes
- to guide the design of future solar farms

Background

- Industrial process hearing operations provide cost-effective heat supply and renewability
- One form is solar farms, collections of ground-mounted solar arrays that supply electricity to the power grid
- Adaptive systems can be used as a more efficient method to harvest solar energy by rotating the farm's solar arrays in accordance to changing conditions in the surrounding environment
- Solar energy can be used to direct the movement of solar panels to maximize sunlight collection without the need of an external energy source.

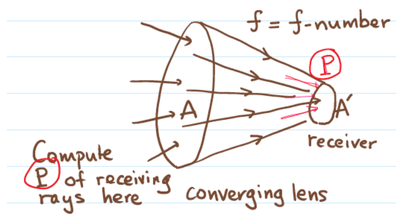
Methods

This project consists of:

- mathematical modeling of one-dimensional arrays of mirrors used to direct sunlight to one point
- methods from heat transfer, optics, programming, and optimization that are used to guide the rotation of mirrors to maximize the collection and redirection of sunlight to one point during various times of the day as the location of the sun changes.

Results

1. Converging lens: A' is the derivative of A
   ➔A=(pi)r^2
   ➔A'=2(pi)r



2. Solve for T(temperature of the sun) for equation:
   F= σ(T^4)(R/d)^2
   σ= Bottzman-Stefan constant= 5.67*10^-8 (J/s)/ M^2*K^2)
   F=Flux= effect that appears to pass through a surface/substance

3. Approximate f-number (the ratio of the system's focal length to the diameter of entrance(A); measure of lens speed)

Results

Code structure:

- Data in classes
- Stored input data
- Data types
  - -Mirrors (location of mirror, angle of mirror given by outward normal vector of each mirror
  - -Location of sun (3D vector)
  - -Location of collectors

Conclusions

- Using this potential code structure would make recycling heat and energy more efficient and less costly
- This method of solar energy collection reduces the need for third-party energy sources, thereby possibly decreasing the cost of implementing this system.
- Future Applications: Build models of this potential solar farm using the information presented.

References

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