Heliostat Field Annual Electricity Generation Maximization Algorithm

Algorithm 1 Heliostat Field Annual Electricity Generation Calculation

Require: H_t: Tower height, $M_i = (x_i, y_i, 6)$: Heliostat coordinates, N: Number of heliostats

Ensure: E_{year}: Annual electricity generation, $\overline{P}_{\text{electric}}$: Average power

Initialize $E_{\text{total}} \leftarrow 0$
for $n = 1$ to 365 **do** ▷ Day loop
    $\delta \leftarrow 23.45^\circ \times \sin\left(\frac{2\pi(n-80)}{365}\right)$
    for $t_{\text{solar}} = t_{\text{sunrise}}$ to t_{sunset} **do** ▷ Time loop
        Calculate solar position (α_s, γ_s)
        $I_{\text{dni}} \leftarrow \text{CalculateDNI}(\alpha_s)$
        $P_{\text{field}} \leftarrow 0$
        for each heliostat i **do**
            Calculate mirror normal $\hat{\mathbf{n}}_i$
            $\eta_{\cos} \leftarrow \hat{\mathbf{n}}_i \cdot \mathbf{i}$
            if $\eta_{\cos} > 0$ **then**
                $P_i \leftarrow I_{\text{dni}} \times A_m \times \rho \times \eta_{\cos} \times \eta_{\text{atm}}$
                $P_{\text{field}} \leftarrow P_{\text{field}} + P_i$
            end if
        end for
        $E_{\text{total}} \leftarrow E_{\text{total}} + P_{\text{field}} \times \Delta t \times \eta_{\text{th}}$
    end for
end for
$\overline{P}_{\text{electric}} \leftarrow E_{\text{total}}/8760$
return $E_{\text{total}}, \overline{P}_{\text{electric}}$