Heliostat Drives

SolarDynamics

State-of-the-Art

- Medium scale heliostats (>20m^2): slewing drive + linear actuators
- Large scale heliostats (>120m^2): hydraulic drives

Challenges

- Dynamic load governed by highest tracking wind speed
  - Leads to low utilization because majority of drive lifetime sees low, nominal wind speeds/loads
  - Defining a lifetime load profile/histogram is challenging. Function of site wind speed and direction and heliostat location in field
- Qualifying performance/reliability over 30-year lifetime
  - Heliostat performance is highly sensitive to drive wear overtime
  - Accelerated lifetime testing needed which subjects the drive to the wear mechanisms present in real environment
  - Heliostat performance over time in existing fields is not public knowledge

Opportunities

- Closed-loop control will enable less stiff and less precise drives
- Gearboxes are sized by fatigue life, and it is common to use a constant design load. A better approach is to use the heliostat's histogram of drive loads to size components.
- Develop standards for heliostat drive testing

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Heliostat Field Control

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- Local heliostat control: custom integrated controllers and PLC based controllers
- Field communication: wireless and wired communication
  - Largest network: Brightsource Ashalim Plot B - 50,600 wireless heliostats

Challenges

- Achieving low cost heliostat field control is primarily a challenge for small scale heliostats
- Requires using custom integrated controller
  - High up-front engineering cost, typically specific to heliostat design
- Wireless field communication needed to keep costs low
  - Commercial deployments are typically first-of-a-kind in terms of network scale
  - Wireless performance is a function of environment which necessitates a solar field with intended heliostat for testing
  - Must guard against wireless signal jamming and interception by potential attacks

Opportunities

- Mixing wired and wireless communication solutions in the field
- Existing solar fields could be used to test wireless field communication

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