

PROCEEDINGS OF SPIE

# ***Advances in Solar Energy: Heliostat Systems Design, Implementation, and Operation II***

**David Haas  
Marc Röger**  
*Editors*

**5–6 August 2025  
San Diego, California, United States**

*Sponsored and Published by*  
SPIE

**Volume 13600**

Proceedings of SPIE 0277-786X, V. 13600

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Advances in Solar Energy: Heliostat Systems Design, Implementation, and Operation II*, edited by David Haas, Marc Röger, Proc. of SPIE 13600, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510691087

ISBN: 9781510691094 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2025 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL  
LIBRARY**

SPIEDigitalLibrary.org

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# Contents

v *Conference Committee*

---

## HELIOSTATS AND THEIR ROLL IN CSP

---

- 13600 02 **Status of standardization work for solar thermal electric plants for solar thermal electric plants** [13600-5]

---

## CURRENT AND PLANNED HELIOSTAT-BASED CSP PLANTS

---

- 13600 03 **Plant and components life cycle, degradation, and mitigations** [13600-9]
- 13600 04 **New materials and plant/parts manufacturing for CSP** [13600-10]
- 13600 05 **Ultra-accelerated weathering system: restoration, optical characterization, and validation** [13600-12]
- 13600 06 **Advanced high strength steel heliostat structures** [13600-38]

---

## HELIOSTAT OPTICS DESIGN, MANUFACTURING, AND EDUCATION

---

- 13600 07 **Twisting heliostat technology enabling high temperature industrial processes and solar electric power generation** [13600-15]
- 13600 08 **Integrating concentrating solar power technologies into the Northeastern University engineering curriculum** [13600-16]

---

## HELIOSTAT OPTICS: METROLOGY

---

- 13600 09 **In-situ slope measurement system for heliostat daytime operation** [13600-22]
- 13600 0A **On-site precision heliostat metrology using starlight** [13600-23]

---

## FIELD OPTIMIZATION, O&M, PERFORMANCE I

---

- 13600 0B **Advancing heliostat field measurement and characterization: insights from international collaboration and workshop outcomes** [13600-41]