

# EPRI Transmission Line Reference Book—Wind-Induced Conductor Motion: The “Orange Book”

**Reworked by an international team of experts, this new edition provides an essential resource for all utilities involved in transmission line design and maintenance.**

**One of the major challenges faced by electric utilities and transmission companies is identifying and preventing costly damage to overhead transmission lines caused by wind-induced conductor motion.**

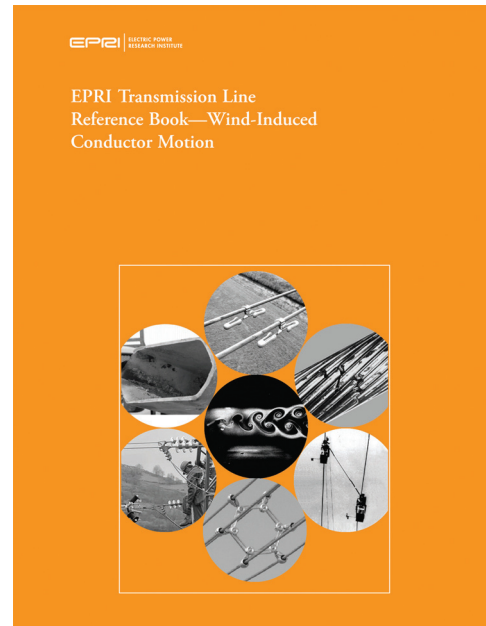
**To help utilities diagnose and solve conductor motion issues, EPRI has updated the long-time industry standard *EPRI Transmission Line Reference Book—Wind-Induced Conductor Motion (1012317)*, known to generations of transmission engineers as the “Orange Book.”**

The book has been reworked by an international team of experts to provide users with the best possible practical tool for designing overhead lines to minimize damage from wind-induced conductor motion and for analyzing existing lines to improve their performance in the windy conditions.

## Addressing an Urgent Challenge

Probably no other large structure has as much of its mass in highly flexible form, and so continuously exposed to the forces of the wind, as does the modern transmission line. This makes the line susceptible to sustained cyclic conductor motions, which can take the form of vibration, galloping, or other types of movement. Because conductors are supported and supplemented by thousands of pieces of hardware, many opportunities for damage arise during these motions. Conductors and their auxiliaries are critical and expensive components that are difficult to inspect while lines are in service. Therefore, problems caused by conductor motion must either be anticipated and prevented during the design and construction stages or resolved at high cost after visible damage or motion has occurred.

In the past two decades, industry restructuring and downsizing have added to the challenge of diagnosing and solving conductor motion issues. Companies are operating with leaner budgets, smaller staffs, and less expertise as veteran engineers retire. Meanwhile, maintaining transmission reliability has become more important than ever as lines are pushed to their limits to move more power over longer distances. In this resource-constrained environment, transmission engineers need the best, most current information available to maintain transmission reliability and to control inspection and maintenance costs.



## Audience

The Orange Book is intended for transmission and distribution line designers and staff responsible for maintenance of overhead lines, interpretation of line failures, and correction of poor designs.

## Application and Value

The new Orange Book gives today’s transmission engineers ready access to fundamental information on the mechanics of conductor motion as well as the latest developments in technology and practices. Although the book is a reference rather than a design manual, the overhead line designer should find it helpful in several ways:

- Recognizing and properly identifying cyclic conductor motion when it occurs
- Anticipating the circumstances in which it may be expected
- Becoming familiar with protection methods currently in use
- Understanding the theoretical principles (where known) upon which currently used protection methods operate
- Evaluating the cost effectiveness of current or proposed protection methods

- Soliciting proposals or bids relative to the protection of new or existing lines
- Critically evaluating such proposals and the claims made for them
- Formulating tests or test programs for evaluating proposed protection systems

### **New Material and Organization**

The content of the earlier edition has been significantly expanded and updated to reflect the latest in conductor technology, new materials and methods, and current utility needs and practices.

Areas covered include aeolian vibration, conductor fatigue, conductor galloping, and wake-induced oscillation, with new chapters on fiber-optic cables and transient dynamic motions of overhead lines. Each conductor behavior is explored in depth in separate chapters that examine the causes, mechanisms, incidence, types of motion, factors influencing motion, resulting damage, and protection methods associated with each behavior.

The book presents one or more detailed theoretical analyses for each type of conductor behavior, together with available supporting (or conflicting) data from laboratory tests and field tests. The book discusses the strengths and limitations of the theories and the various types of testing methods and includes extensive references to the work of other researchers.

### **Training and Services**

In addition to providing an essential reference to practicing engineers, the Orange Book is also a valuable training tool. EPRI offers workshops and training seminars structured around the topics presented in the book, which are expanded in lectures delivered by some of the experts who wrote the topical chapters. Training is offered at EPRI's Lenox High-Voltage Test Facility, at regional centers, and on-site at individual utilities—where course content is tailored to the utility's specific needs and transmission system.

### **Table of Contents**

Chapter 1:	<b>Introduction</b>
Chapter 2:	<b>Aeolian Vibration</b>
Chapter 3:	<b>Fatigue of Overhead Conductors</b>
Chapter 4:	<b>Galloping Conductors</b>
Chapter 5:	<b>Bundle Conductor Oscillations</b>
Chapter 6:	<b>Overhead Fiber-Optic Cables</b>
Chapter 7:	<b>Other Motions</b>
Appendix 1:	<b>Conductor Tables</b>
Appendix 2:	<b>Units and Conversion Factors</b>
Appendix 3:	<b>Catenary Effects</b>

### **Contact Information**

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 ([askepri@epri.com](mailto:askepri@epri.com)).

#### **Electric Power Research Institute**

3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA  
800.313.3774 • 650.855.2121 • [askepri@epri.com](mailto:askepri@epri.com) • [www.epri.com](http://www.epri.com)

© 2008 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER... SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute, Inc.