

**EFFICIENT MULTIRATE
TELETRAFFIC LOSS MODELS
BEYOND ERLANG**

**EFFICIENT MULTIRATE
TELETRAFFIC LOSS MODELS
BEYOND ERLANG**

Efficient Multirate Loss Models

Ioannis D. Moscholios
University of Peloponnese

Michael D. Logothetis
University of Patras

LOGO

Copyright ©<provide-copyright-year> by John Wiley & Sons, Inc. All rights reserved.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Published simultaneously in Canada.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services please contact our Customer Care Department with the U.S. at 877-762-2974, outside the U.S. at 317-572-3993 or fax 317-572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print, however, may not be available in electronic format.

Library of Congress Cataloging-in-Publication Data:

Title, etc

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

To my parents

Contents

| | |
|--|-----------|
| Contributors | ix |
| Foreword | xi |
| Preface | xiii |
| Acknowledgments | xv |
| Acronyms | xvii |
| Introduction | xxi |
| | |
| 1 This is Chapter One Title containing authors and affiliations | 1 |
| 1.1 This is First Level Heading | 1 |
| 1.1.1 This is Second Level Heading | 2 |
| | |
| 2 This is Chapter Two Title | 5 |
| 2.1 This is First Level Heading | 5 |
| 2.1.1 This is Second Level Heading | 8 |
| | |
| 3 This is Chapter Three Title | 13 |
| 3.1 This is First Level Heading | 13 |
| Example for Quotes | 14 |
| Example for Extracts | 14 |
| Example for Pull quotes | 15 |
| Example for Verse/Poetry | 15 |
| Example for Epigraph | 16 |
| Example for Dialogue | 16 |
| Exercises | 16 |

4

This is Chapter Four Title

19

4.1

This is First Level Heading

19

Example for Feature Fixed

20

Example for Boxes

21

5

This is Chapter Five Title

29

5.1

This is First Level Heading

29

Enunciations

30

Computer Material

31

Icons

32

Problems

32

A

This is Appendix Title

35

A.1

This is First Level Heading

35

A.1.1 This is Second Level Heading

35

B

This is Appendix Title

39

B.1

This is First Level Heading

39

B.1.1 This is Second Level Heading

39

C

This is Appendix Title

43

C.1

Import Codes From Code File

43

C.2

Write Codes In Tex File

43

Index

47

Contributors

MASAYKI ABE, Fujitsu Laboratories Ltd., Fujitsu Limited, Atsugi, Japan

L. A. AKERS, Center for Solid State Electronics Research, Arizona State University, Tempe,
Arizona

G. H. BERNSTEIN, Department of Electrical and Computer Engineering, University of Notre
Dame, Notre Dame, South Bend, Indiana; formerly of Center for Solid State Electronics
Research, Arizona State University, Tempe, Arizona

Foreword

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Preface

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

place
date

Acknowledgments

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

I. R. S.

Acronyms

| | |
|----------|--------------------------------------|
| ASTA | Arrivals See Time Averages |
| BHCA | Busy Hour Call Attempts |
| BR | Bandwidth Reservation |
| b.u. | bandwidth unit(s) |
| CAC | Call / Connection Admission Control |
| CBP | Call Blocking Probability(-ies) |
| CCS | Centum Call Seconds |
| CDTM | Connection Dependent Threshold Model |
| CS | Complete Sharing |
| DiffServ | Differentiated Services |
| EMLM | Erlang Multirate Loss Model |
| erl | The Erlang unit of traffic-load |
| FIFO | First in - First out |

| | |
|---------|---|
| GB | Global balance |
| GoS | Grade of Service |
| ICT | Information and Communication Technology |
| IntServ | Integrated Services |
| IP | Internet Protocol |
| ITU-T | International Telecommunication Unit – Standardization sector |
| LB | Local balance |
| LHS | Left hand side |
| LIFO | Last in - First out |
| MMPP | Markov Modulated Poisson Process |
| MPLS | Multiple Protocol Labeling Switching |
| MRM | Multi-Retry Model |
| MTM | Multi-Threshold Model |
| PASTA | Poisson Arrivals See Time Averages |
| PDF | Probability Distribution Function |
| pdf | probability density function |

| | |
|------|----------------------------|
| PFS | Product Form Solution |
| QoS | Quality of Service |
| r.v. | random variable(s) |
| RED | random early detection |
| RHS | Right hand side |
| RLA | Reduced Load Approximation |
| SIRO | service in random order |
| SRM | Single-Retry Model |
| STM | Single-Threshold Model |
| TCP | Transport Control Protocol |
| TH | Threshold(s) |
| UDP | User Datagram Protocol |

Introduction

The word *traffic* becomes *teletraffic* in telecommunications, as communications becomes telecommunications to indicate technology use, e.g., conversation from some distance through phones or Internet. The term teletraffic covers all kinds of computer communication traffic and telecom traffic. This book includes teletraffic loss models.

Chapter 1

This is Chapter One Title containing authors and affiliations¹

Author I,^{1*} Author II,² Author III,¹ and Author IV³

¹*I Author Organization Division Name, Organization Name, Postal Code, Part of the Country, City Name, Street Name, Country*

²*II Author Organization Division Name, Organization Name, Postal Code, Part of the Country, City Name, Street Name, Country*

³*II Author Organization Division Name, Organization Name, Postal Code, Part of the Country, City Name, Street Name, Country*

*Corresponding Author: Author; corresauthor@gmail.com

Abstract Title Here: Abstract para text. Abstract para text. Abstract para text. Abstract para text. Abstract para text. Abstract para text. Abstract para text. Abstract para text.

Abstract next para text. Abstract para text. Abstract para text. Abstract para text. Abstract para text. If multiple abstracts exists, then **absgroup** tag will be inserted by the tool.

Abstract text. Abstract text. Abstract text. Abstract text.

Keywords: Key word 1, Key word 2, ...

1.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget,

¹This is a sample for chapter footnote.

consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

1.1.1. This is Second Level Heading

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

For example, multiple citations from the of this : citet: Fernàndez-Castillo et al. [6], Fornito et al. [7], citep: [5, 8]. As you see in Table 1.2, the citations are to their reference in the bibliography. Refer Figure 1.1 for details:

For example, multiple citations from the of this : citet: Ding et al. [5], French and Pavlidis

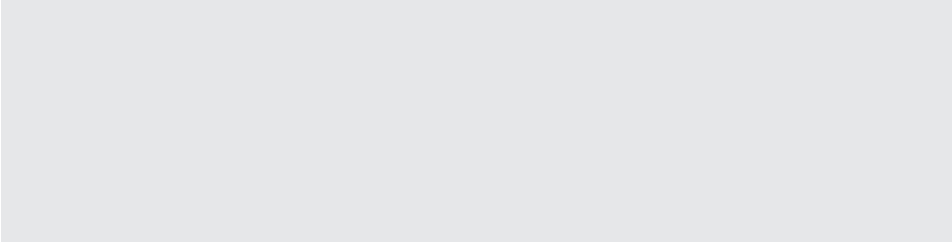


Figure 1.1: Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.

[8], citep: [5, 8]. As you see in Table 1.1, the citations are to their reference in the bibliography (Equation 1.1).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^\mu D_\mu\Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi \tag{1.1}$$

1.1.1.1. This is Third Level Heading

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^\mu D_\mu\Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi \tag{1.2}$$

This is Fourth Level Heading. Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

This is Fifth Level Heading. Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at,

Table 1.1: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

Table 1.2: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers (Equation 1.2).

Chapter 2

This is Chapter Two Title

After reading this chapter you should be able to:

-
- List the main subsectors and components of the environmental and energy infrastructure
 - Explain www.google.com the function of each infrastructure sector
 - Identify components related to environmental and energy infrastructure
-

2.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac

orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

The manifestation of solar activity¹ (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

- 1. Arabic Numbered list: Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text.
- 2. Item text Item text Item text Item text Item text Item text Item text.
- 3. Arabic Numbered list: Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text.
- 4. Arabic Numbered list: Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text.
- 5. Item text Item text Item text Item text Item text Item text Item text.
- 6. Arabic Numbered list: Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text.
- 7. Item text Item text Item text Item text Item text Item text Item text.
- 8. Arabic Numbered list: Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text.
- 9. Item text Item text Item text Item text Item text Item text Item text.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

¹This is an example for first text footnote. This is an example for first text footnote. This is an example for first text footnote.

- Bulleted list text. Item text Item text Item text Item text Item text Item text Item text.
- Item text Item text Item text Item text Item text Item text Item

An example for uppercase alphabet list:

- A. Upper case alpha list text. Item text Item text Item text Item text Item text Item text Item text.
- B. Item text Item text Item text Item text Item text Item text Item text. Item text Item text.

An example for lowercase alphabet list:

- a. Lower case alpha list text. Item text Item text Item text Item text Item text Item text Item text.
- b. Item text Item text Item text Item text Item text Item text Item text. Item text Item text.
- c. Item text Item text Item text Item text Item text Item text Item text. Item text Item text.

Eample for uppercase Roman List:

- I. Upper case roman list text. Item text Item text Item text Item text Item text Item text Item text Item text.
- II. Item text Item text Item text Item text Item text Item text Item text Item text. Item text Item text.
- III. Item text Item text Item text Item text Item text Item text

Eample for lowercase roman List:

- i. Lower case roman list text. Item text Item text Item text Item text Item text Item text Item text Item text.
- ii. Item text Item text Item text Item text Item text Item text Item text Item text. Item text Item text.
- iii. Item text Item text Item text Item text Item text Item text

Example for custom list:

Step 1 Custom list, if the list environment not matched with above.

Step 2 Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text Item text. Item text Item text.

Step 3 Item text Item text Item text Item text Item text Item text

Example for unnumbered list:

Unnumbered list text. Item text Item text Item text Item text Item text Item text Item text Item text.

Item text Item text Item text Item text Item text Item text Item text Item text. Item text Item text.

For example, multiple citations from the bibliography of this article: citet: Bartelle et al. [1], Consortium [2], citep: [3, 4]. As you see in Table 2.1, the citations are to their reference in the bibliography.

2.1.1. This is Second Level Heading

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus

Table 2.1: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

2.1.1.1. This is Third Level Heading

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor

Table 2.2: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

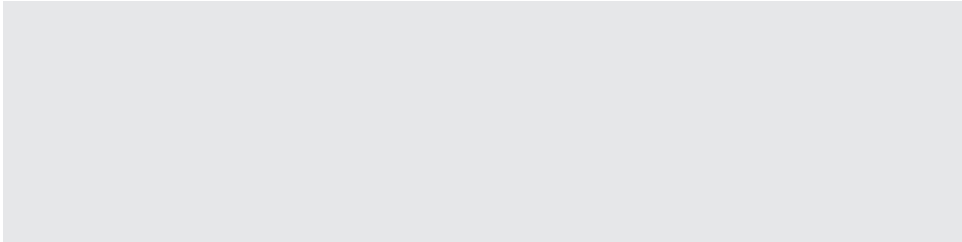


Figure 2.1: Figure Title.

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.

Source: Figure Source.

vitae risus porta vehicula.

Refer Figure 2.1 and Table 2.2 for more details.

This is Fourth Level Heading. Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

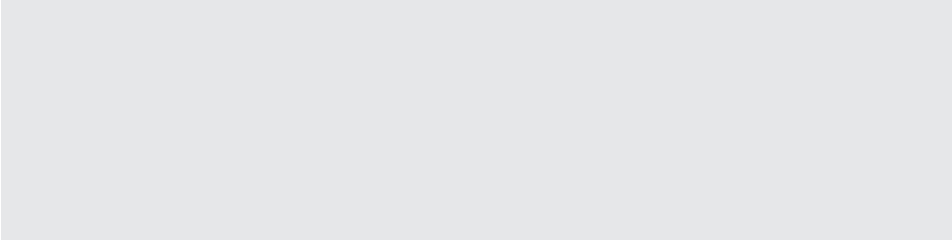


Figure 2.2: Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.

This is Fifth Level Heading. Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

The manifestation of solar activity² (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers (Equation 2.1).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^{\mu}D_{\mu}\Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi \tag{2.1}$$

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for

²This is an example for second text footnote. This is an example for second text footnote. This is an example for second text footnote.

terrestrial observers(Equation 2.2).

$$\mathcal{L} = i\bar{\Psi}\gamma^\mu D_\mu\Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi \quad (2.2)$$

Chapter 3

This is Chapter Three Title

After reading this chapter you should be able to:

-
- List the main subsectors and components of the environmental and energy infrastructure
 - Explain www.google.com the function of each infrastructure sector
 - Identify components related to environmental and energy infrastructure
-

3.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

The manifestation of solar activity¹ (flares, bursts, and others) occurs over the whole Sun,

¹This is an example for first text footnote. This is an example for first text footnote. This is an example for first text footnote.

and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

Example for Quotes

Quote Head

Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote Text Quote Text

Quote Source

Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote Text Quote Text

Quote Source

“Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote Text Quote Text”

Quote Source

Example for Extracts

Extract Head Extract Text Extract Text Extract Text Extract Text Extract Text Extract
Text Extract Text Extract Text Extract Text Extract Text Extract Text Extract Text

Extract Source

Extract Text Extract Text Extract Text Extract Text Extract Text Extract Text Extract
Text Extract Text Extract Text Extract Text Extract Text Extract Text

Extract Source

‘Extract Text Extract Text Extract Text Extract Text Extract Text Extract Text Extract

Text Extract Text Extract Text Extract Text Extract Text Extract”

Extract Source

Example for Pull quotes

“Pull Quote Text Pull Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote”

Pull Quote Source

Pull Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote Text

Pull Quote Source

Pull Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text Quote Text
Quote Text Quote Text Quote Text Quote Text

Pull Quote Source

Example for Verse/Poetry

Poetry Title

Verse Text here Verse Text here Verse Text here Verse Text here
Verse Text here Verse Text here Verse Text here Verse Text hereVerse Text here
Verse Text here Verse Text here Verse Text here
Verse Text here Verse Text here Verse Text here Verse Text here
Verse Text here Verse Text here Verse Text here Verse Text here

Source: Verse/Poetry Source

Example for Epigraph

*pigraph without section head Text Epigraph Text Epigraph Text Epigraph Text Epigraph
Text Epigraph Text Epigraph Text Epigraph Text Epigraph Text*

Epigraph Source

Example for Dialogue

Speaker A: Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text.

Speaker B: Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text.

Speaker A: Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text. Dialogue Text.

The manifestation of solar activity² (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

Exercises

1. Item 1 What is the meaning of life?
- Ans: b
- a. for italic text
 - b. for bold text
 - c. for small caps

²This is an example for first text footnote. This is an example for first text footnote. This is an example for first text footnote.

2. Item 2 What is the meaning of life?

Ans: 42

3. Item 3 What is the meaning of life?

Solution: Solution Text. Solution Text. Solution Text. Solution Text. Solution Text. Solution
Text. Solution Text. Solution Text. Solution Text. Solution Text. Solution Text. Solution Text.
Solution Text. Solution Text. Solution Text. Solution Text. Solution Text. Solution Text. Solution

Text.

Chapter 4

This is Chapter Four Title

After reading this chapter you should be able to:

-
- List the main subsectors and components of the environmental and energy infrastructure
 - Explain www.google.com the function of each infrastructure sector
 - Identify components related to environmental and energy infrastructure
-

4.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac

orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

The manifestation of solar activity¹ (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth's surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

Example for Feature Fixed

TIP Feature Head

Featurefixed Text Featurefixed Text Featurefixed Text Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text.

FEATURE FIXED HEAD

Feature Fixed Feature Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed Text Featurefixed
Text Featurefixed Text.

¹This is an example for first text footnote. This is an example for first text footnote. This is an example for first text footnote.

Example for Boxes

Feature Title 4.3

Feature Section

Feature Subsection

Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession.

- 1. item text. Feature text list environment. Feature text list environment. Feature text list environment. Feature text list environment. Feature text list environment.
- 2. item text. Feature text list environment. Feature text list environment. Feature text list environment. Feature text list environment.
- Bulleted list text. Item text Item text Item text Item text Item text Item text Item text.
- Item text Item text Item text Item text Item text Item text Item



Figure 4.1: Figure Title. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure

Caption. Figure Caption. Figure Caption. *Source: Figure Source.*

Note: For sample purpose we have used dummy eps image. Please use only the below format:

```
\begin{figure}  
\includegraphics{FigName.eps}  
\caption{\title{Figure Title.}Figure Caption.  
Figure Caption. Figure Caption. Figure Caption.  
Figure Caption. Figure Caption. Figure Caption.  
\source{\textit{Source:} Figure Source.}\label{fig1}}  
\end{figure}
```

Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession. Engineers uphold and advance the integrity, honor and dignity of the engineering profession.

Table 4.1: Enter table caption here.

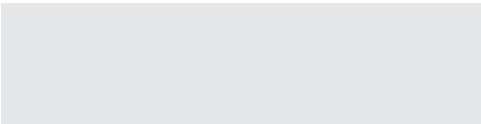
| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

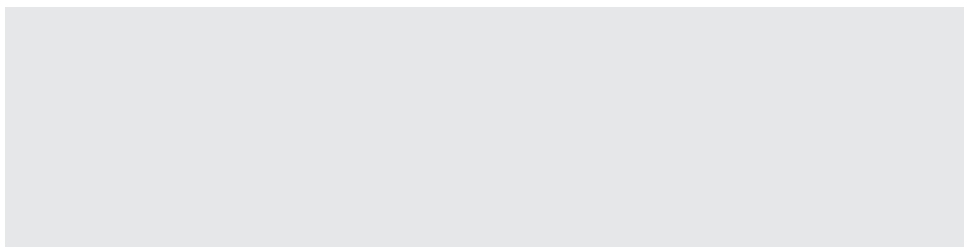
² Example for a second table footnote.

The sample for unnumbered Figure with caption



Unnumbered Figure Title. Unnumbered Figure caption. Unnumbered Figure caption. Unnumbered Figure caption. Unnumbered Figure caption. *Unnumbered Figure Source*

The sample for unnumbered Figure without caption



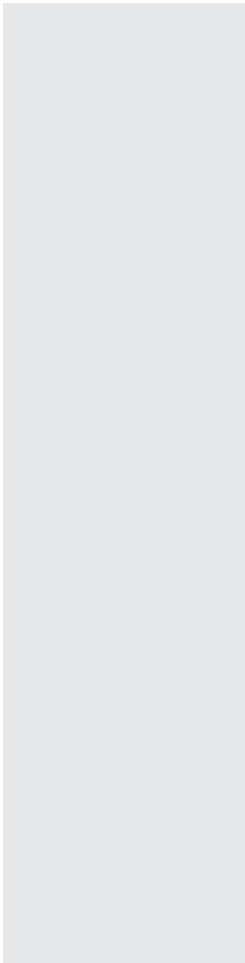


Figure 4.2: Figure Title

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.

Source: Figure Source.

This is an unnumbered table

Enter unnumbered table caption here. Enter unnumbered table caption here. Enter unnumbered table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 | –12.8 |
| 4 | –10.0 | 12,900 | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |
| 6 | –20.0 | 20,000 ¹ | –16.0 |

¹ This is unnumbered table footnote
Source: This is unnumbered table source. This is unnumbered table footnote

Table 4.2: Enter sideways table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 | –12.8 |
| 4 | –10.0 | 12,900 | –10.0 |
| 5 | –15.0 | 17,100 ¹ | –25.2 |

¹ This is table footnote

For Unnumbered Table without caption and source/note:

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 | –12.8 |
| 4 | –10.0 | 12,900 | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |
| 6 | –20.0 | 20,000 | –16.0 |

Chapter 5

This is Chapter Five Title

After reading this chapter you should be able to:

-
- List the main subsectors and components of the environmental and energy infrastructure
 - Explain www.google.com the function of each infrastructure sector
 - Identify components related to environmental and energy infrastructure
-

5.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac

orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

The manifestation of solar activity¹ (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers.

Enunciations

For bold head and italic body:

Theorem 5.1(Theorem Title): *Theorem content. Theorem content. Theorem content. Theorem content. Theorem content. Theorem content.*

Lemma 5.1: *Lemma content. Lemma content. Lemma content. Lemma content. Lemma content. Lemma content. Lemma content. Lemma content. Lemma content. Lemma content.*

Corollary 5.1: *Corollary content. Corollary content. Corollary content. Corollary content. Corollary content. Corollary content. Corollary content. Corollary content. Corollary content. Corollary content.*

For bold head and roman text:

Definition 5.1(Definition Title): Definition content. Definition content. Definition content. Definition content. Definition content. Definition content. Definition content. Definition content. Definition content.

Remark 5.1: Remark content.

¹This is an example for first text footnote. This is an example for first text footnote. This is an example for first text footnote.

For proofs:

Proof. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content. Proof content.

Computer Material

```
class CEcosystem;  
struct Chromosome  
{  
    unsigned char gene[CHROMOLENGTH];  
};
```

Icons

Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon
text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon text.
Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon text.
Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon text. Icon
Icon text. Icon text. Icon text. Icon text.

Following is an example for Problems section:

Problems

Related Instruction. Related Instruction. Related Instruction. Related Instruction. Related Instruction.

1. First problem text. First problem text. First problem text.

$$f(x) = \begin{cases} kx^2(1-x^3), & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

continuation of first problem text.

Hint: Problem hint text. Problem hint text.

2. Second problem text. Second problem text. Second problem text:

1. $9 < X < 90$.
2. $X < 90$.
3. $X > 90$, given that $X > 9$.

3. Third problem text. Third problem text.

$$F_X(x) = \begin{cases} 0, & x < 0, \\ \frac{1}{2}\sqrt{x} + \frac{1}{2}(1 - e^{-\sqrt{x}}), & 0 \leq x \leq 1, \\ \frac{1}{2} + \frac{1}{2}(1 - e^{-\sqrt{x}}), & x > 1. \end{cases}$$

Continuation of third problem text.

4. Fourth problem text.

$$f_X(x) = \frac{k}{x}, \quad k > 0.$$

Continuation of fourth problem text

1. some text.
2. some other text.
3. more text.

Appendix A

This is Appendix Title

A.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

A.1.1. This is Second Level Heading

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique,

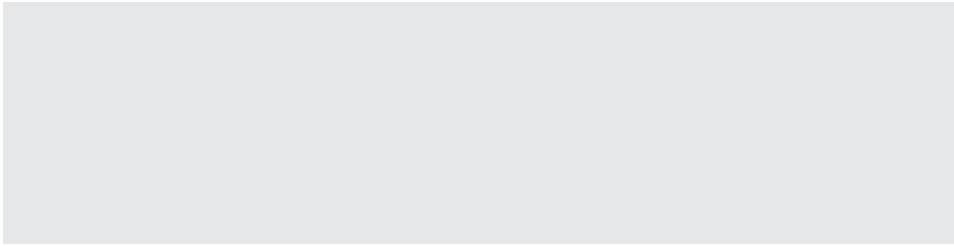


Figure A.1: Figure Title

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.
Figure Caption.

Source: Figure Source.

libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus
adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae,
placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec,
suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed
lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent
euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus.
Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

A.1.1.1. This is Third Level Heading

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices.
Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst.
Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean
placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar
elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor
vitae risus porta vehicula.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun,
and most of radio astronomy observations are made from the Earth’s surface, whereas a
significant part of solar radio events (those from the far side of the Sun) is not available for

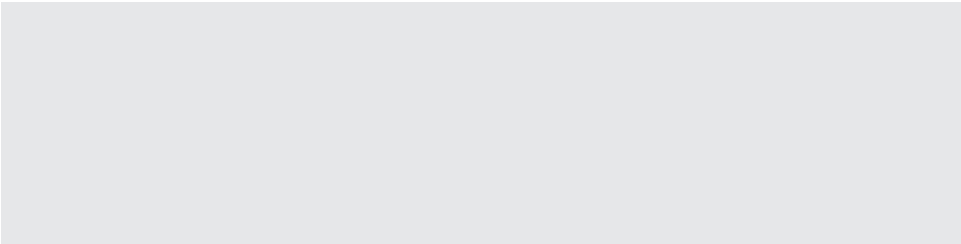


Figure A.2: Figure Title

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.
Figure Caption.
Source: Figure Source.

Table A.1: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

terrestrial observers (Equation A.1, Table A.1 and Figure A.1).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^\mu D_\mu \Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi$$

(A.1)

This is Fourth Level Heading. Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed

Table A.2: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers (Equation A.2, Table A.2 and Figure A.2).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^{\mu}D_{\mu}\Psi - \frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu} - m\bar{\Psi}\Psi$$

(A.2)

This is Fifth Level Heading. Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

Appendix B

This is Appendix Title

B.1. This is First Level Heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

B.1.1. This is Second Level Heading

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique,

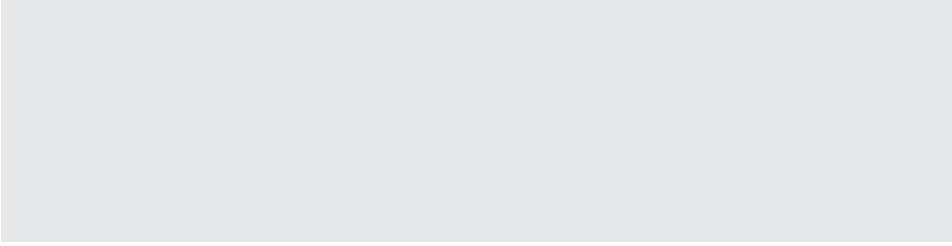


Figure B.1: Figure Title.

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.
Figure Caption.

Source: Figure Source.

libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus
adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae,
placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec,
suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed
lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent
euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus.
Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun,
and most of radio astronomy observations are made from the Earth’s surface, whereas a
significant part of solar radio events (those from the far side of the Sun) is not available for
terrestrial observers (Equation B.1, Table B.1 and Figure B.1).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^{\mu}D_{\mu}\Psi - \frac{1}{4}F_{\mu\nu}^aF^{a\mu\nu} - m\bar{\Psi}\Psi \tag{B.1}$$

B.1.1.1. This is Third Level Heading

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices.
Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst.
Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean

Table B.1: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|------------|---------------------|---------------------|--------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

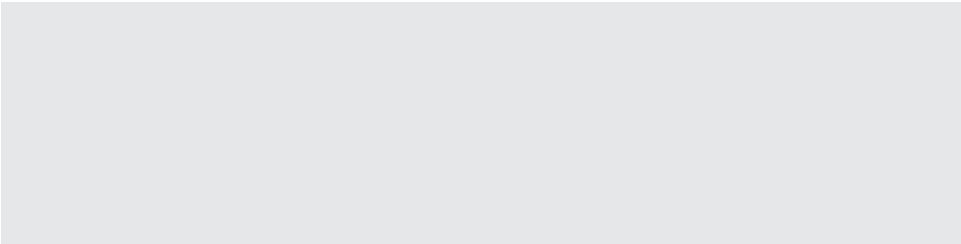


Figure B.2: Figure Title.

Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption. Figure Caption.

Source: Figure Source.

placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

The manifestation of solar activity (flares, bursts, and others) occurs over the whole Sun, and most of radio astronomy observations are made from the Earth’s surface, whereas a significant part of solar radio events (those from the far side of the Sun) is not available for terrestrial observers (Equation B.2, Table B.2 and Figure B.2).

$$\mathcal{L} \quad \mathcal{L} = i\bar{\Psi}\gamma^{\mu}D_{\mu}\Psi - \frac{1}{4}F_{\mu\nu}^aF^{a\mu\nu} - m\bar{\Psi}\Psi$$

(B.2)

Table B.2: Enter table caption here.

| Tap number | Relative power (dB) | Relative delay (ns) | Relative mean power (dB) |
|---------------|------------------------|------------------------|-----------------------------|
| 3 | 0–9.0 | 68,900 ¹ | –12.8 |
| 4 | –10.0 | 12,900 ² | –10.0 |
| 5 | –15.0 | 17,100 | –25.2 |

Source: Example for table source text.

¹ Example for a first table footnote. Example for a first table footnote. Example for a first table footnote. Example for a first table footnote.

² Example for a second table footnote.

This is Fourth Level Heading. Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

This is Fifth Level Heading. Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

Appendix C

This is Appendix Title

C.1. Import Codes From Code File

```
1  #%%
2  import numpy as np
3  import scipy.stats as st
4
5  import matplotlib.pyplot as plt
6  import seaborn as sns
7
8  sns.set_palette("Paired")
```

C.2. Write Codes In Tex File

```
1  import numpy as np
2
3  def incmatrix(genl1,genl2):
4      m = len(genl1)
5      n = len(genl2)
6      M = None #to become the incidence matrix
7      VT = np.zeros((n*m,1), int) #dummy variable
8
9      #compute the bitwise xor matrix
10     M1 = bitxormatrix(genl1)
11     M2 = np.triu(bitxormatrix(genl2),1)
12
13     for i in range(m-1):
14         for j in range(i+1, m):
15             [r,c] = np.where(M2 == M1[i,j])
16             for k in range(len(r)):
17                 VT[(i)*n + r[k]] = 1;
18                 VT[(i)*n + c[k]] = 1;
19                 VT[(j)*n + r[k]] = 1;
20                 VT[(j)*n + c[k]] = 1;
```

```
21
22         if M is None:
23             M = np.copy(VT)
24         else:
25             M = np.concatenate((M, VT), 1)
26
27         VT = np.zeros((n*m,1), int)
28
29     return M
```

Bibliography

- [1] B. B. Bartelle, A. Barandov, and A Jasanoff. Molecular fMRI. *Journal of Neuroscience*, 36: 4139–4148, 2016.
- [2] CONVERGE Consortium. Sparse whole-genome sequencing identifies two loci for major depressive disorder. *Nature*, 523:588–591, 2015.
- [3] S. Darmanis, S. A. Sloan, Y. Zhang, M. Enge, C. Caneda, L. M. Shuer, and S. R. Quake. A survey of human brain transcriptome diversity at the single cell level. *Proceedings of the National Academy of Sciences*, 112:7285–7290, 2015.
- [4] A. Di Martino, C. G. Yan, Q. Li, E. Denio, F. X. Castellanos, K. Alaerts, and M. P. Milham. The autism brain imaging data exchange: Towards a large-scale evaluation of the intrinsic brain architecture in autism. *Molecular Psychiatry*, 19:659–667, 2014. doi: 10.1038/mp.2013.78.
- [5] S. L. Ding, J. J. Royall, S. M. Sunkin, L. Ng, B. A. Facer, P. Lesnar, and E. S. Lein. Comprehensive cellular-resolution atlas of the adult human brain. *Journal of Comparative Neurology*, 524:3127–3481, 2016. doi: 10.1002/cne.24080.
- [6] N. Fernández-Castillo, B. Cormand, C. Roncero, C. Sánchez-Mora, L. Grau-Lopez, B. Gonzalvo, and M. Ribasés. Candidate pathway association study in cocaine dependence: The control of neurotransmitter release. *World Journal of Biological Psychiatry*, 13:126–134, 2012. doi: 10.3109/15622975.2010.551406.
- [7] A. Fornito, A. Zalesky, D. S. Bassett, D. Meunier, I. Ellison-Wright, M. Yücel, and E. T. Bullmore. Genetic influences on cost-efficient organization of human cortical functional networks. *Journal of Neuroscience*, 31:3261–3270, 2011. doi: 10.1523/JNEUROSCI.4858-10.2011.
- [8] L. French and P. Pavlidis. Relationships between gene expression and brain wiring in the adult rodent brain. *PLoS Computational Biology*, e1001049:7, 2011.

Index

article, 2
automatically
 hyperlinked
 citations, 2

bibliography, 2

main entry with turn over lines main entry with
 turn over lines
subentry with turn over lines subentry with turn
 over lines
subsubentry with turn over lines subsubentry
 with turn over lines, 3