Now assume only the best 3 channel states are used

$$\frac{0.9}{\gamma_0} = 1 + \sum_{i=1}^{3} \frac{1}{\gamma_i} p_i \Rightarrow \gamma_0 = 0.6742 < 1 \quad \text{...ok!}$$

$$\frac{S(\gamma)}{S} = \begin{cases} 1.3832 & \gamma = \gamma_1 = 10 \\ 1.1670 & \gamma = \gamma_2 = 3.1623 \\ 0.4832 & \gamma = \gamma_3 = 1 \\ 0 & \gamma = \gamma_4 = 0.1 \end{cases}$$

$$\frac{C/B}{S} = 2.3389bns/Hz$$

- (b)  $\sigma = 0.7491$  $C/B = \log_2(1 + \sigma) = 0.8066bps/Hz$
- (c)  $(\frac{C}{D})_{max} = 2.1510bps/Hz$  obtained by using the best 2 channel states. With  $p_{out} = 0.1 + 0.2 = 0.3$
- 7. (a) Maximize capacity given by

$$C = \max_{S(\gamma) \in f} \int_{S(\gamma)p(\gamma)d\gamma = S} \int_{\gamma} B \log \left(1 + \frac{S(\gamma)\gamma}{S}\right) p(\gamma) d\gamma.$$

Construct the Lagrangian function

$$\mathcal{L} = \int_{\gamma} B \log \left( 1 + \frac{S(\gamma) \gamma}{\overline{S}} \right) p(\gamma) d\gamma - \lambda \int \frac{S(\gamma)}{\overline{S}} p(\gamma) d\gamma$$

Taking derivative with respect to  $S(\gamma)$ , (refer to discussion section notes) and setting it to zero, we obtain,

$$\frac{S(\gamma)}{\overline{S}} = \left\{ \begin{array}{ll} \frac{1}{\gamma_0} - \frac{1}{\gamma} & \gamma \ge \gamma_0 \\ 0 & \gamma < \gamma_0 \end{array} \right.$$

Now, the threshold value must satisfy

$$\int_{\gamma_0}^{\infty} \left(\frac{1}{\gamma_0} - \frac{1}{\gamma}\right) p(\gamma) d\gamma = 1$$

Evaluating this with  $p(\gamma) = \frac{1}{10}e^{-\gamma/10}$ , we have

$$1 = \frac{1}{10\gamma_0} \int_{\gamma_0}^{\infty} e^{-\gamma/10} d\gamma - \frac{1}{10} \int_{\gamma_0}^{\infty} \frac{e^{-\gamma/10}}{\gamma} d\gamma \qquad (1)$$

$$= \frac{1}{\gamma_0}e^{-\gamma_0/10} - \frac{1}{10}\int_{\frac{\gamma_0}{10}}^{\infty} \frac{e^{-\gamma}}{\gamma}d\gamma$$
 (2)

$$= \frac{1}{\gamma_0}e^{-\gamma_0/10} - \frac{1}{10}EXPINT(\gamma_0/10)$$
 (3)

where EXPINT is as defined in matlab. This gives  $\gamma_0 = 0.7676$ . The power adaptation becomes

$$\frac{S(\gamma)}{\overline{S}} = \left\{ \begin{array}{ll} \frac{1}{0.7676} - \frac{1}{\gamma} & \gamma \geq 0.7676 \\ 0 & \gamma < 0.7676 \end{array} \right.$$

# **Solution Manual Wireless Communication Goldsmith**

Erchin Serpedin, Thomas Chen, Dinesh Rajan

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Wireless Communications Andrea Goldsmith, 2005-08-08 A comprehensive introduction to the basic principles design techniques and analytical tools of wireless communications Solutions Manual Wireless Communications Zhigang Rong, Theodore S Rappaport, 2009-11-01 Wireless Sensor Networks Ibrahiem M. M. El Emary, S. Ramakrishnan, 2013-08-28 Supplying comprehensive coverage of WSNs this book covers the latest advances in WSN technologies It considers some of theoretical problems in WSN including issues with monitoring routing and power control and details methodologies that can provide solutions to these problems It examines applications of WSN across a range of fields including health defense military transportation and mining Addressing the main challenges in applying WSNs across all phases of our life it explains how WSNs can assist in community development **Mathematical Foundations for** Signal Processing, Communications, and Networking Erchin Serpedin, Thomas Chen, Dinesh Rajan, 2017-12-04 Mathematical Foundations for Signal Processing Communications and Networking describes mathematical concepts and results important in the design analysis and optimization of signal processing algorithms modern communication systems and networks Helping readers master key techniques and comprehend the current research literature the book offers a comprehensive overview of methods and applications from linear algebra numerical analysis statistics probability stochastic processes and optimization From basic transforms to Monte Carlo simulation to linear programming the text covers a broad range of mathematical techniques essential to understanding the concepts and results in signal processing telecommunications and networking Along with discussing mathematical theory each self contained chapter presents examples that illustrate the use of various mathematical concepts to solve different applications Each chapter also includes a set of homework exercises and readings for additional study This text helps readers understand fundamental and advanced results as well as recent research trends in the interrelated fields of signal processing telecommunications and networking It provides all the necessary mathematical background to prepare students for more advanced courses and train specialists The Wireless Age ,1918 Book Bulletin of the Chicago Public Library Chicago Public working in these areas **Book Bulletin** Chicago Public Library, 1918 Space Antenna Handbook William A. Imbriale, Steven Library, 1919 Shichang Gao, Luigi Boccia, 2012-05-02 This book addresses a broad range of topics on antennas for space applications First it introduces the fundamental methodologies of space antenna design modelling and analysis as well as the state of the art and anticipated future technological developments Each of the topics discussed are specialized and contextualized to the space sector Furthermore case studies are also provided to demonstrate the design and implementation of antennas in actual applications Second the authors present a detailed review of antenna designs for some popular applications such as satellite communications space borne synthetic aperture radar SAR Global Navigation Satellite Systems GNSS receivers science instruments radio astronomy small satellites and deep space applications Finally it presents the reader with a comprehensive

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#### **Table of Contents Solution Manual Wireless Communication Goldsmith**

- 1. Understanding the eBook Solution Manual Wireless Communication Goldsmith
  - The Rise of Digital Reading Solution Manual Wireless Communication Goldsmith
  - Advantages of eBooks Over Traditional Books
- 2. Identifying Solution Manual Wireless Communication Goldsmith
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Solution Manual Wireless Communication Goldsmith
  - User-Friendly Interface
- 4. Exploring eBook Recommendations from Solution Manual Wireless Communication Goldsmith

- Personalized Recommendations
- Solution Manual Wireless Communication Goldsmith User Reviews and Ratings
- Solution Manual Wireless Communication Goldsmith and Bestseller Lists
- 5. Accessing Solution Manual Wireless Communication Goldsmith Free and Paid eBooks
  - Solution Manual Wireless Communication Goldsmith Public Domain eBooks
  - Solution Manual Wireless Communication Goldsmith eBook Subscription Services
  - Solution Manual Wireless Communication Goldsmith Budget-Friendly Options
- 6. Navigating Solution Manual Wireless Communication Goldsmith eBook Formats
  - o ePub, PDF, MOBI, and More
  - Solution Manual Wireless Communication Goldsmith Compatibility with Devices
  - Solution Manual Wireless Communication Goldsmith Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Solution Manual Wireless Communication Goldsmith
  - Highlighting and Note-Taking Solution Manual Wireless Communication Goldsmith
  - Interactive Elements Solution Manual Wireless Communication Goldsmith
- 8. Staying Engaged with Solution Manual Wireless Communication Goldsmith
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Solution Manual Wireless Communication Goldsmith
- 9. Balancing eBooks and Physical Books Solution Manual Wireless Communication Goldsmith
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Solution Manual Wireless Communication Goldsmith
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Solution Manual Wireless Communication Goldsmith
  - Setting Reading Goals Solution Manual Wireless Communication Goldsmith
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Solution Manual Wireless Communication Goldsmith

- Fact-Checking eBook Content of Solution Manual Wireless Communication Goldsmith
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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