

Now assume only the best 3 channel states are used

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

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

$$C/B = 2.3389\text{bps/Hz}$$

(b) $\sigma = 0.7491$

$$C/B = \log_2(1 + \sigma) = 0.8066\text{bps/Hz}$$

(c) $\left(\frac{C}{B}\right)_{\max} = 2.1510\text{bps/Hz}$ obtained by using the best 2 channel states.
With $p_{\text{out}} = 0.1 + 0.2 = 0.3$

7. (a) Maximize capacity given by

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

Construct the Lagrangian function

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

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

$$\frac{S(\gamma)}{S} = \begin{cases} \frac{1}{\gamma_0} - \frac{1}{\gamma} & \gamma \geq \gamma_0 \\ 0 & \gamma < \gamma_0 \end{cases}$$

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

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

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

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

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

$$\frac{S(\gamma)}{S} = \begin{cases} \frac{1}{0.7676} - \frac{1}{\gamma} & \gamma \geq 0.7676 \\ 0 & \gamma < 0.7676 \end{cases}$$

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**William A. Imbriale, Steven Shichang
Gao, Luigi Boccia**



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Bor-Sen Chen,2023-12-05 This book introduces multi objective design methods to solve multi objective optimization problems MOPs of linear nonlinear dynamic systems under intrinsic random fluctuation and external disturbance The MOPs of multiple targets for systems are all transformed into equivalent linear matrix inequality LMI constrained MOPs Corresponding reverse order LMI constrained multi objective evolution algorithms are introduced to solve LMI constrained MOPs using MATLAB All proposed design methods are based on rigorous theoretical results and their applications are focused on more practical engineering design examples Features Discusses multi objective optimization from an engineer s perspective Contains the theoretical design methods of multi objective optimization schemes Includes a wide spectrum of recent research topics in control design especially for stochastic mean field diffusion problems Covers practical applications in each chapter like missile guidance design economic and financial systems power control tracking minimization design in communication and so forth Explores practical multi objective optimization design examples in control signal processing communication and cyber financial systems This book is aimed at researchers and graduate students in electrical engineering control design and optimization **U.S. Government Research Reports** ,1957 Airman's Guide ,1957 **Radio Facsimile** Alfred Norton Goldsmith,1938 Batcheller Collection **Book Review Digest** ,1924 **Book Bulletin** Chicago Public Library,1918 Catalog of Copyright Entries. Third Series Library of Congress. Copyright Office,1963 Includes Part 1 Number 1 Books and Pamphlets Including Serials and Contributions to Periodicals January June **New York Magazine** ,1985-06-17 New York magazine was born in 1968 after a run as an insert of the New York Herald Tribune and quickly made a place for itself as the trusted resource for readers across the country With award winning writing and photography covering everything from politics and food to theater and fashion the magazine s consistent mission has been to reflect back to its audience the energy and excitement of the city itself while celebrating New York as both a place and an idea **QST.** ,1962

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