

EE Qualifying Examination

January 2006

Yoshihisa Yamamoto

1. A linear amplifier enhances the signal and noise powers by the same gain factor. In addition, amplifier internal noise is added to the output signal and so the signal-to-noise ratio is always degraded by linear amplification. Why is a linear amplifier used in optical communication systems?

2. A nonlinear regenerator reproduces a clean signal pulse from a distorted signal pulse. The signal-to-noise ratio of the output pulse is larger than that of the input pulse. However, there is a price we have to pay. What is the cost we have to pay for improving the signal-to-noise ratio in a nonlinear regenerator?

Qualifying Exam Questions

January 11 – 15, 2010

Yoshi Yamamoto

What are thermal noise and quantum noise in physical systems? You can choose any one of the following systems and describe the origins of those fluctuations.

- 1. Simple macroscopic conductor**
- 2. Mesoscopic conductor under ballistic regime**
- 3. pn junction under either forward or reverse bias**
- 4. Tunnel junction**
- 5. Laser/maser**
- 6. Parametric oscillator**
- 7. Mechanical oscillator**
- 8. Bose-Einstein condensation**

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EE QUALIFYING EXAMINATION

January 23 – 27, 2012

Yoshihisa Yamamoto

1. What is the difference between amplifiers and oscillators?
Discuss the difference in terms of external pumping levels with respect to oscillation threshold and applications.

2. What is the difference between negative conductance oscillators/amplifiers and nonlinear susceptance oscillators/amplifiers?

3. What is the difference between pre-amplifiers and on-line amplifiers?