

Fuzzy Modeling of an ROF Communication System for CATV channels over DWDM network

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Fiber advantages for carrying analog signals

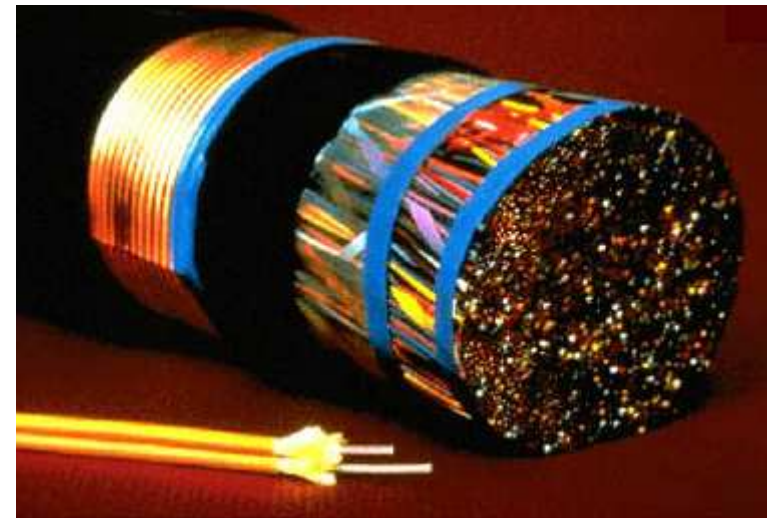
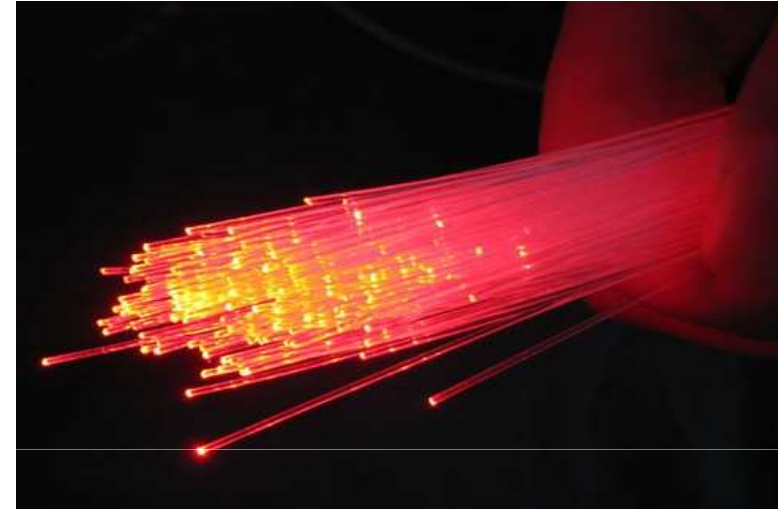
➤ **Capacity** Optical fibres carry signals with much **less energy loss** than copper cable and with a **much higher bandwidth**.

➤ **Size and Weight** Optical fiber cables are much lighter and thinner than copper cables with the same bandwidth. This means that much **less space** is required in underground cabling ducts.

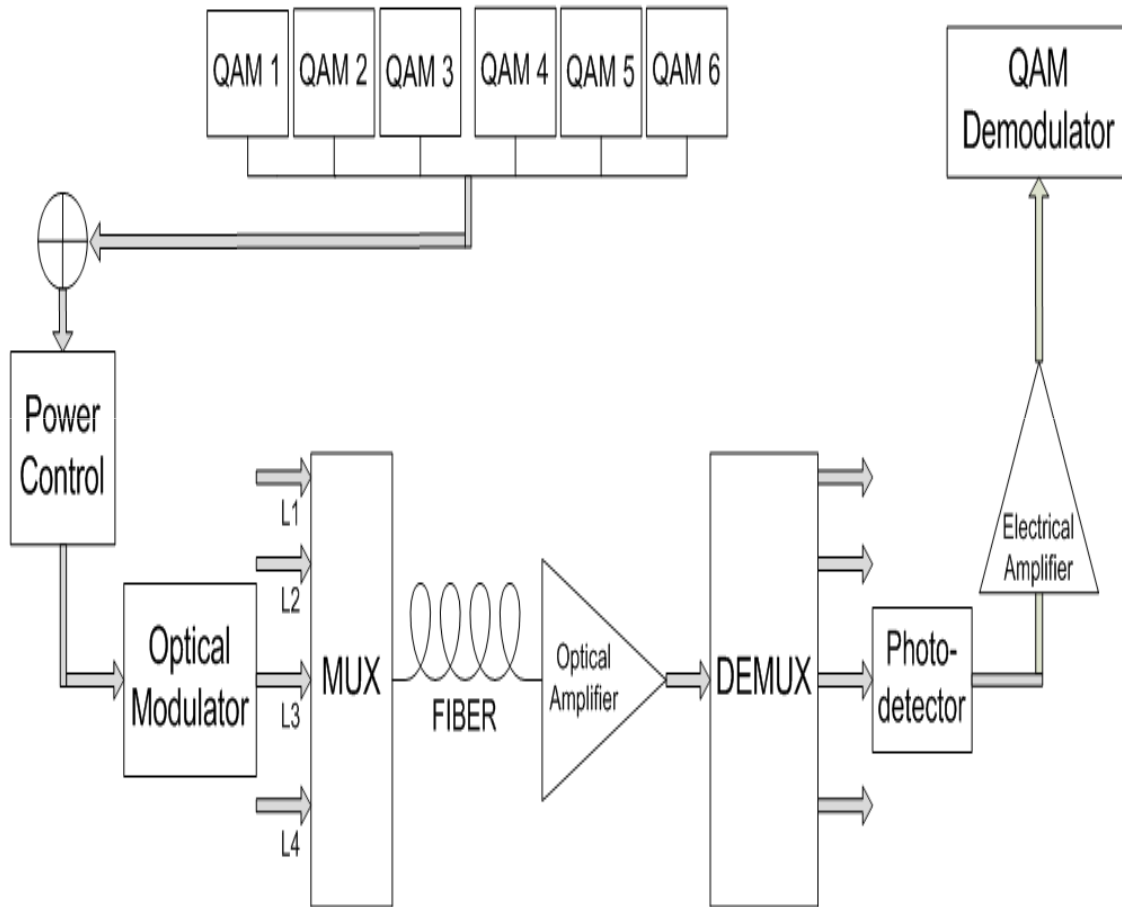
➤ **Security** Optical fibres are much more difficult to tap information from undetected; a great advantage for banks and security installations.

➤ **Immunity** They are **immune to Electromagnetic** interference from radio signals, lightning etc.

➤ **Running Costs** The main consideration in choosing fibre when installing domestic cable TV networks is the electric bill. Although copper coaxial cable can handle the bandwidth requirement over the short distances of a housing scheme, a copper system consumes far more electrical power than fibre, simply to carry the signals.

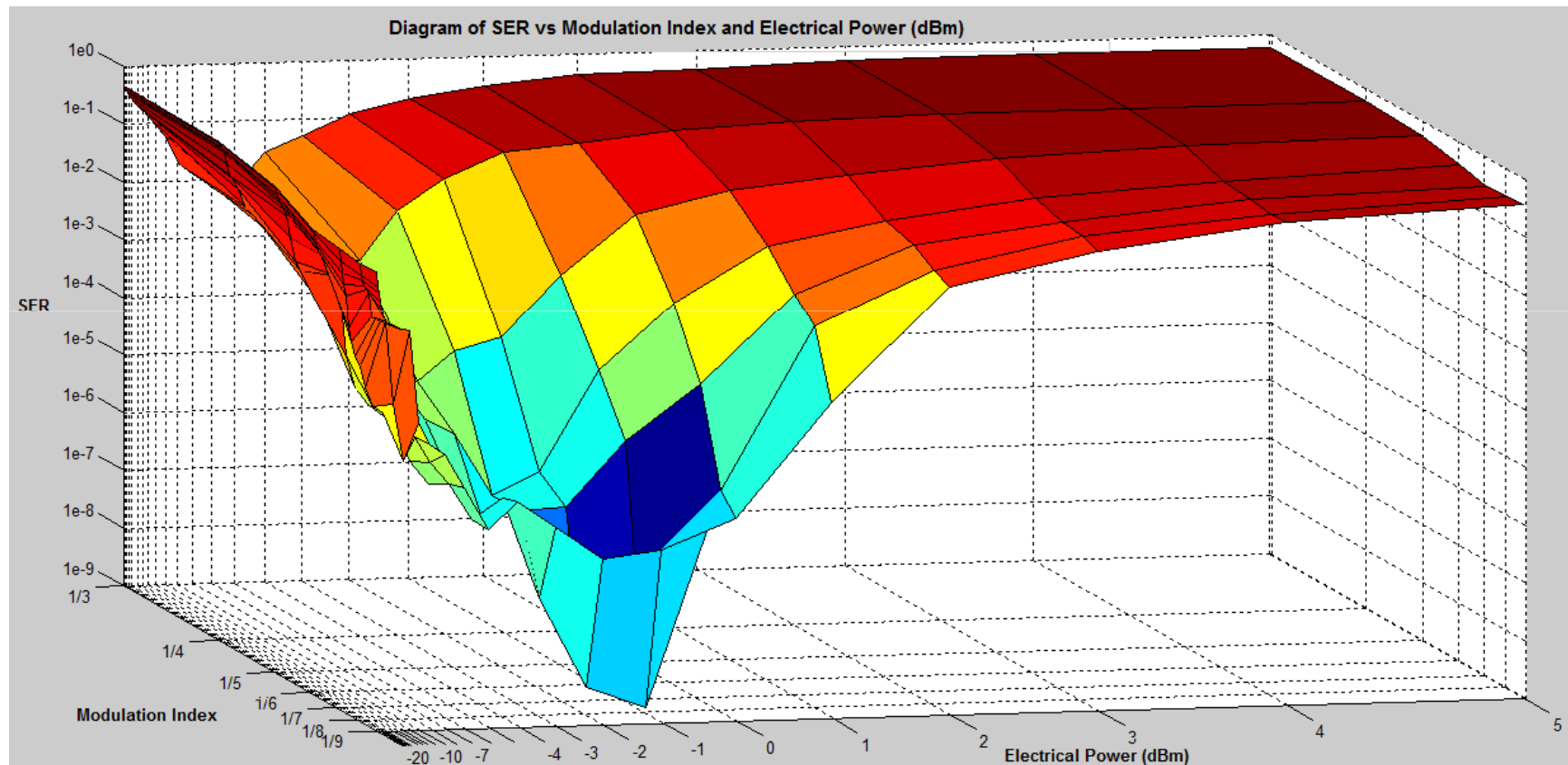


SYSTEM MODEL

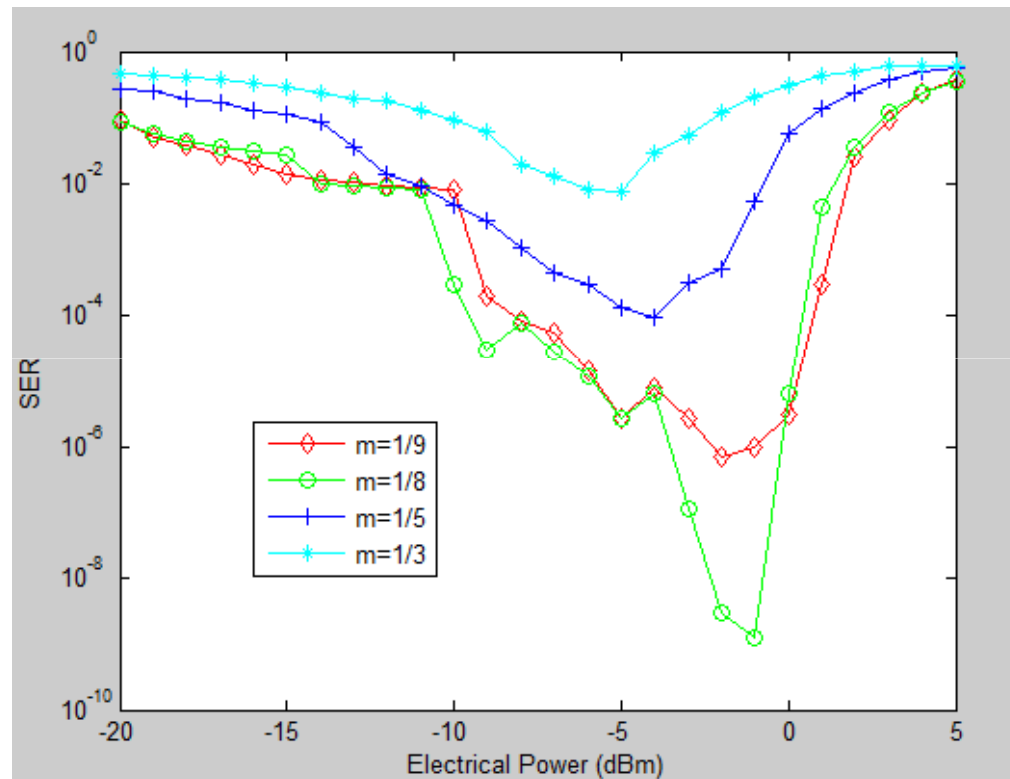


- Six QAM blocks each of which is five 64-QAM channels
- Bit rate of 30 Mb/s for every channel
- Total link bit rate is 900 Mb/s
- Radio Frequencies are set to 301.25 MHz-475.25 MHz
- laser center wavelength is set to 1553 nm
- Fiber length is 40 km
- Laser power is set to 1mW

Diagram obtained from original system simulated in VPI



Up to what level bias current of the Direct modulator can be increased?

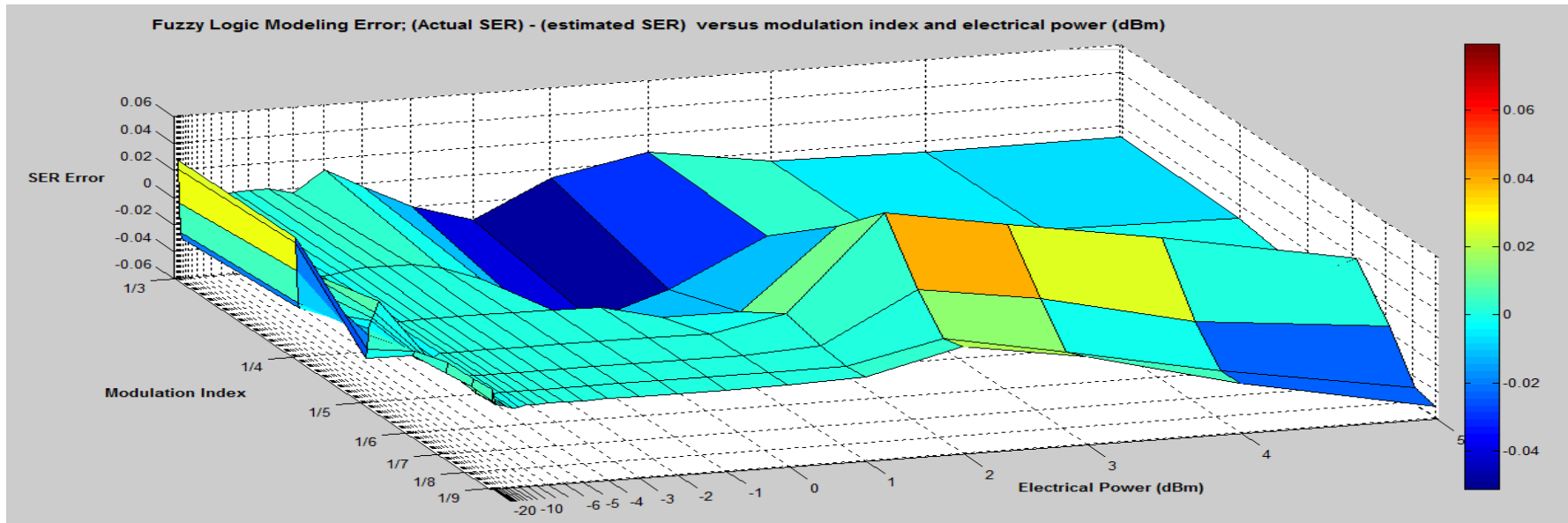
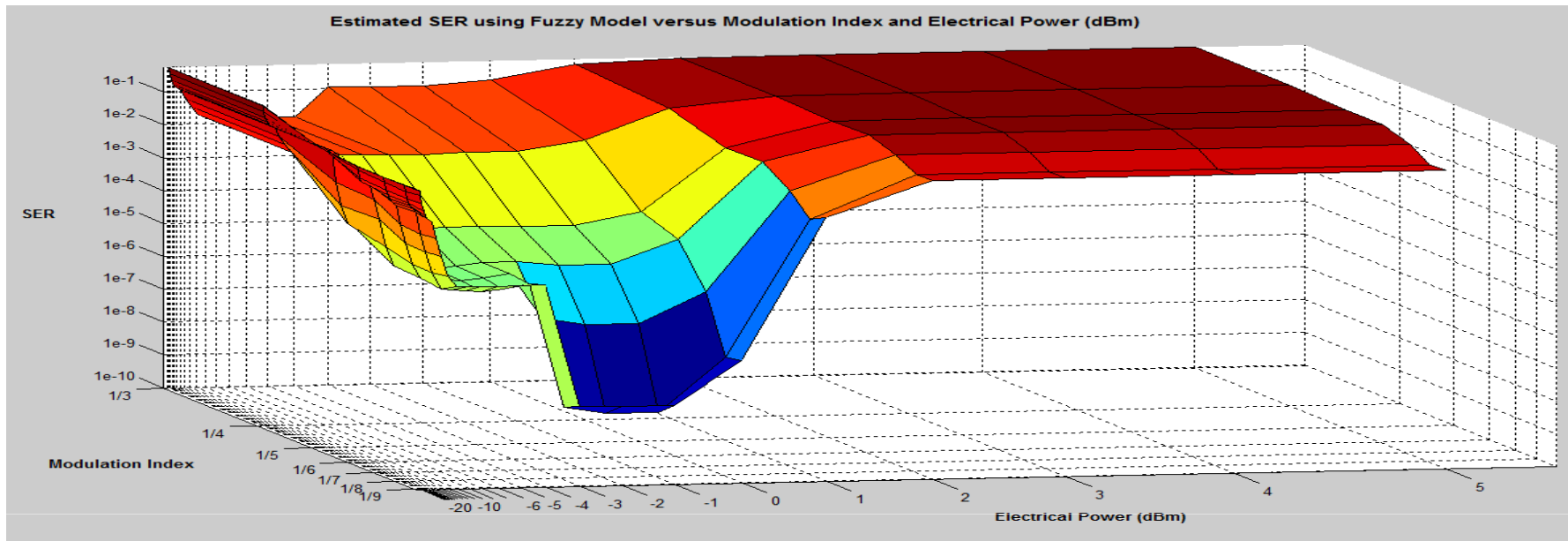


$$\Delta\nu = \frac{-\alpha}{4\pi} \left[\frac{d}{dt} \ln p(t) + k'p(t) \right]$$

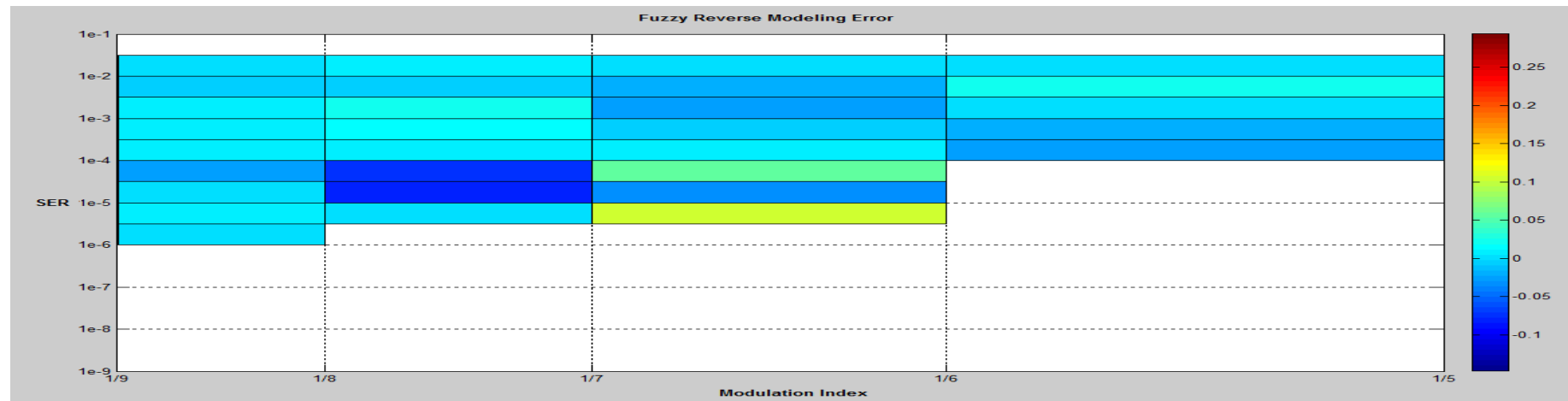
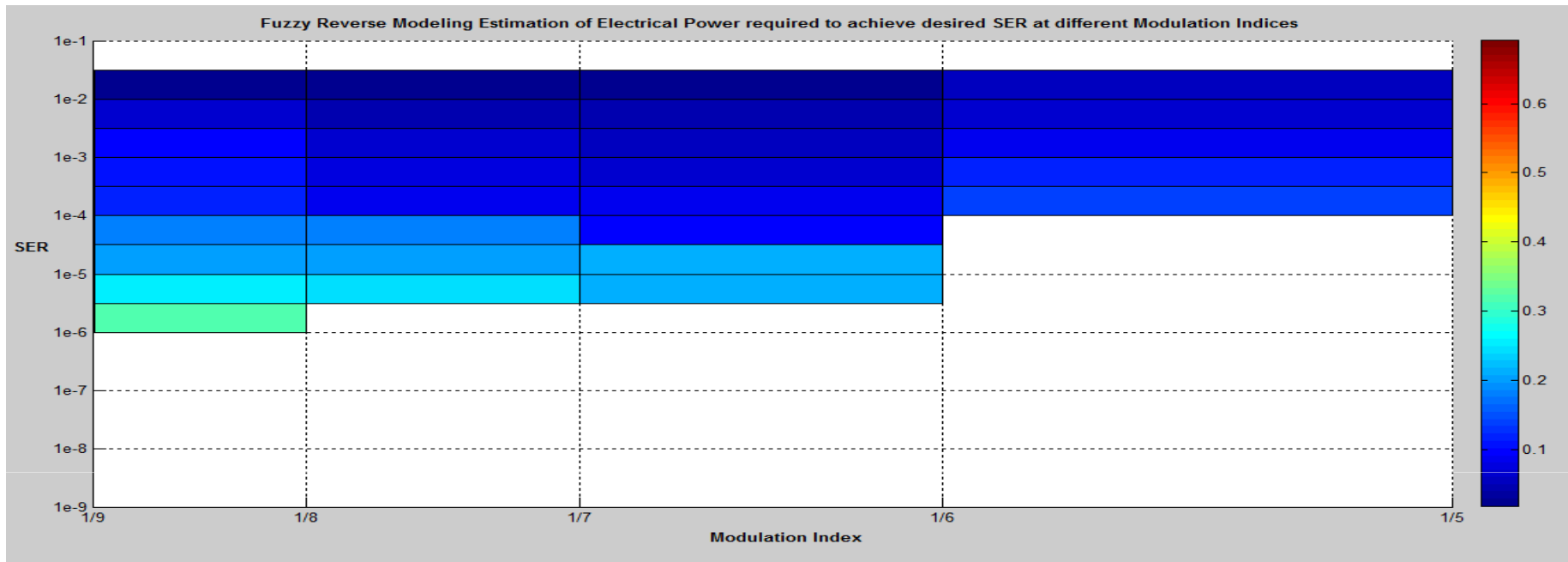
- α is line-width enhancement factor
- $p(t)$ represents output optical power
- k' is a frequency independent factor

There should be a compromised selection of bias level to be large enough to prevent driving the laser below the threshold by modulation current and does not bring uncontrollable extinction ratio power penalty due to large bias level.

Fuzzy Modeling Results



Fuzzy Reverse Modeling



Conclusion

- Using the proposed model of the communication system implemented in VPI helps set the CATV over fiber system to use less electrical power.
- Using Fuzzy model helps predict the necessary amount of electrical power so that the system can be set accordingly in order to achieve an acceptable SER.

THANK YOU

