

# Forward Error Correction for Optical Transmission Systems

## Frank Kerfoot

### Course Description

Forward Error Correction (FEC) is a method of correcting transmission errors using redundant information added to the transmitted messages. As such it provides a mechanism to increase transmission capacity, extend system lengths, and/or lower overall system costs. This tutorial provides an introduction to FEC as it is applied to optical transmission systems. The focus of the course will be on the FEC itself, however, not on other aspects of optical transmission. The course:

- introduces terminology used to define FEC codes,
- presents an intuitive explanation for the need for structured, mathematical techniques to design FEC codes,
- describes the underlying mathematics on which many codes suitable for optical systems are based, including how they are used to design FEC coders and decoders,
- introduces methods of evaluating performance of FEC codes applicable to optical systems,
- describes basic techniques used to implement a practical FEC integrated circuit based on an abstract FEC code,
- and discusses the suitability of a variety of common codes for optical systems, including Reed-Solomon codes, BCH codes, product codes, and soft-decision codes.

### Benefits and Learning Objectives

**Explain** the way in which FEC codes correct errors, including the structured techniques used to design specific codes

**Evaluate** the performance of a particular FEC code in an optical transmission application based on information from the FEC supplier

**Design** an optical transmission system using a particular FEC code

### Intended Audience

The course attendee should have at least a BS-level degree in either engineering or science or equivalent experience. No prior knowledge of forward error correction is required.

### Instructor Biography

Frank Kerfoot is Director of Terminal Engineering at Tyco Telecommunications Laboratories. He was previously responsible for applied research at AT&T Submarine Systems and Tyco Submarine Systems and has held management positions in both system engineering and product development of terminal equipment for optical transmission systems. In all of these roles Mr. Kerfoot has had significant involvement in choosing suitable FEC codes for undersea optical transmission systems, as well as defining architectures for the associated FEC integrated circuits. Mr. Kerfoot received the BSEE degree from Rensselaer Polytechnic Institute and the MSEE degree from Brooklyn Polytechnic Institute.