FIGURE 3.63 Two-dimensional parity check code.

error vector model. The probability of error-detection failure for the single parity check code will be between those of the two channel models. In general, measurement studies are required to characterize the statistics of burst occurrence in specific channels.

3.9.2 Two-Dimensional Parity Checks

A simple method to improve the error-detection capability of a single parity check code is to arrange columns that consist of k information bits followed by a check bit at the bottom of each column, as shown in Figure 3.63. The right-most bit in each row is the check bit of the other bits in the row, so in effect the last column is a "check codeword" over the previous m columns. The resulting encoded matrix of bits satisfies the pattern that all rows have even parity and all columns have even parity.

If one, two, or three errors occur anywhere in the matrix of bits during transmission, then at least one row or parity check will fail, as shown in Figure 3.64. However, some patterns with four errors are not detectable, as shown in the figure.

The two-dimensional code was used in early data link controls where each column consisted of seven bits and a parity bit and where an overall check character was added at the end. The two-dimensional parity check code is another example of a linear code. It has the property that error-detecting capabilities can be identified visually, but it does not have particularly good performance. Better codes are discussed in a later (optional) section on linear codes.

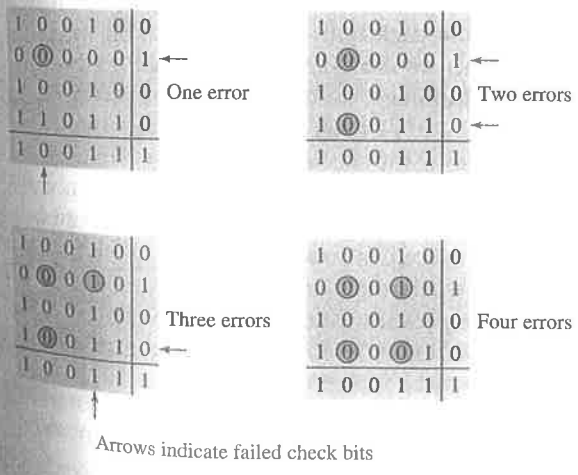

FIGURE 3.64 Detectable and undetectable error patterns for two-dimensional code.