LUNDS UNIVERSITET
Lunds Tekniska Högskola

# KODNINGSTEKNIK EDI042

## Error Control Coding

**Poäng:** 5.0 **Betygskala:** TH **Valfri för:** D4, E4 **Kursansvarig:** Mats Cedervall. **Rekomenderade förkunskaper:** Informationsteori, Digitalteknik **Prestationsbedömning:** Godkänt projekt är ett krav för att få tentera. Den skriftliga tentamen (5 tim) är av problemlösningstyp. Som ett alternativ erbjuds möjligheten till muntlig tentamen. **Webbsida:** http://www.it.lth.se/ecc

**Innehåll:**
Error control coding should protect digital data against errors which occur during transmission over a noisy communication channel or during storage in an unreliable memory. The last decade has been characterized by not only an exceptional increase in data transmission and storage but also in a rapid development in microelectronics providing us with both a need for and the possibility to implement sophisticated algorithms for error control. **Introduction.** Why error control? Block codes - a primer, a first encounter with convolutional codes, block codes vs. convolutional codes. **Convolutional encoders - structural properties.** Convolutional codes and their encoders, the Smith form of polynomial encoding matrices, equivalent and basic encoding matrices, minimal - basic and minimal encoding matrices, minimal encoders, syndrome formers and dual encoders, systematic encoders. **Distance properties of convolutional codes.** Distance measures, distances for cascaded convolutional codes, upper and lower bounds on the free distance, lower bound on the distance profile, path enumeration. **Viterbi decoding.** The Viterbi algorithm, error probability bounds for convolutional codes, quantization of channel outputs. **List decoding.** Decoding with limited resources, list decoding (algorithm, error probability bounds). **Sequential decoding.** The Fano metric, the Stack algorithm, computational analysis, the Fano algorithm. **Convolutional encoders with good distance properties.** Computing distance spectrum (FAST), some classes of rate R = 1/2 encoders. **Block codes.** Reed-Solomon (RS) codes, cyclic codes, discrete Fourier transforms, decoding RS codes (the Berlekamp-Massey algorithm), erasures and errors decoding. **Trellis coded modulation.** Band-limited channels and QAM, coding fundamentals, lattice-type trellis codes, geometrically uniform trellis codes, decoding of modulation codes, precoding.

**Litteratur:**
Johannesson, R. & Zigangirov, K. Sh.: Fundamentals of Convolutional Coding, IEEE Press, 1999.