Advanced Coding Theory

- Bridges between coding theory and graph theory: Factor graphs
- Low-density parity-check (LDPC) codes and factor graphs
- Iterative decoding on factor graphs:
  - Belief propagation (BP)
  - Sum-product algorithm (SPA).
  - Min-sum algorithm (MSA)
- Analytical tools:
  - Density evolution: to analyze waterfall performance
  - Extrinsic Information Transfer (EXIT) Charts: to quantify how information is improved at every iteration
- Asymptotic distance properties of LDPC codes
- Error-floor analysis
- Turbo codes and iterative decoding
  - Interleaver design for Turbo codes
- Serial concatenation and repeat-accumulate (RA) codes
- Emerging coding strategies
  - LDPC convolutional codes
  - Low-density generator-matrix (LDGM) codes
  - Rateless codes
  - Luby Transform (LT) codes
  - Fountain codes
  - Tornado codes
  - Raptor (Rapid Tornado) Codes
  - Lattice Codes and Low-density lattice codes (LDLC)

References:

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☑ Shu Lin and Daniel J. Costello, Jr., **Error Control Coding**, Prentice Hall, Second Edition, 2004.
☑ Sarah J. Johnson, **Iterative Error Correction – Turbo, Low-Density Parity-Check and Repeat-Accumulate Codes**, Cambridge University Press, Dec. 2009.
☑ William Ryan and Shu Lin, **Channel Codes - Classical and Modern**, Cambridge University Press 2009.
☑ Wicker and Kim, **Fundamentals of codes, graphs and iterative decoding**, Kluwer Academic Publishers, 2003.