



LUND
UNIVERSITY

Spatially Coupled Turbo-Like Codes: Convolutional Codes on Graphs

Saeedeh Moloudi
Lund University, Sweden

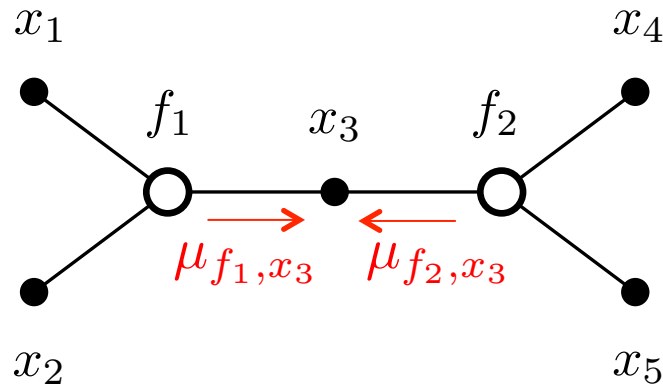
Joint work with Michael Lentmaier, Lund University and
Alexandre Graell i Amat, Chalmers University of Technology

SPCodingSchool, Campinas, Brazil
January 2015

Background

- **Codes on graphs:**

build large and powerful codes out of a set of smaller component codes



$$f(x_1, x_2, x_3, x_4, x_5) = f_1(x_1, x_2, x_3) \cdot f_2(x_3, x_4, x_5)$$

- **Message passing decoding:** (e.g. belief propagation)

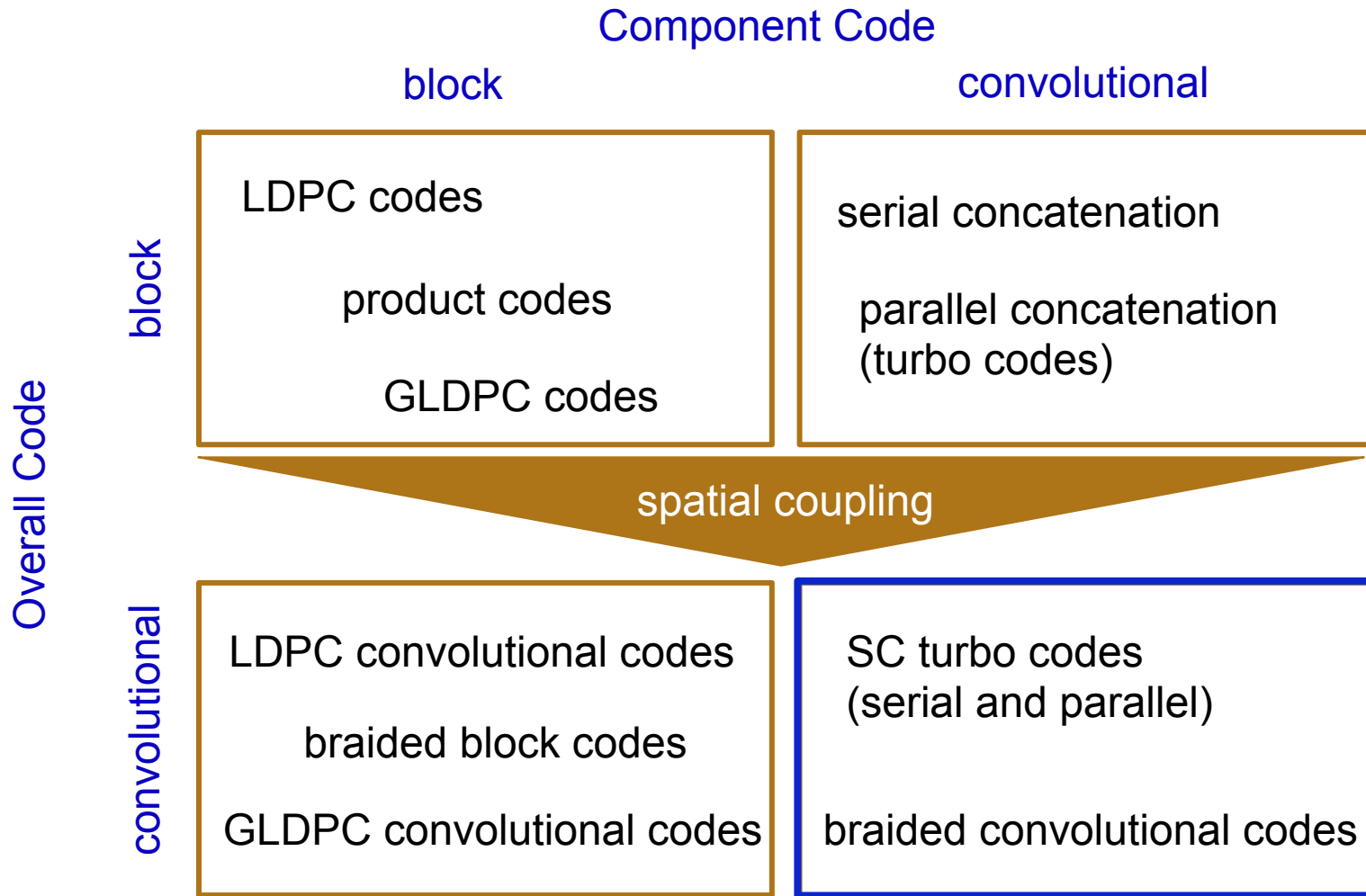
efficient parallel computation of marginals by local computations and exchange of messages within the factor graph

Question:

which influence does the structure of the component codes have and how simple or powerful should they be?



Convolutional Codes on Graphs



Convolutional Codes for Iterative Decoding

Parallel Concatenation:

- + better BP decoding threshold
- worse distance spectrum / error floor
- worse MAP decoding threshold

Serial Concatenation:

- worse BP decoding threshold
- + better distance spectrum / error floor
- + better MAP decoding threshold

Ensemble	Rate	ϵ_{BP}	ϵ_{MAP}
PCC	1/3	0.6428	0.6553
SCC	1/3	0.6118	0.6615
PCC	1/2	0.4606	0.4689
SCC	1/2	0.4010	0.4973

Observation:

optimizing **component** codes for iterative decoding does not necessarily optimize the strength of the **overall code**

Spatial coupling:

can overcome this discrepancy due to **threshold saturation**



On poster ...

I. Ensembles

- Some special spatially coupled ensembles of turbo codes
- Braided convolutional codes

II. Density evolution analysis

- Transfer functions of component codes
- Deriving exact density evolution equations
- Investigating threshold saturation

