Joint LDPC Codes for Multi-User Relay Channel

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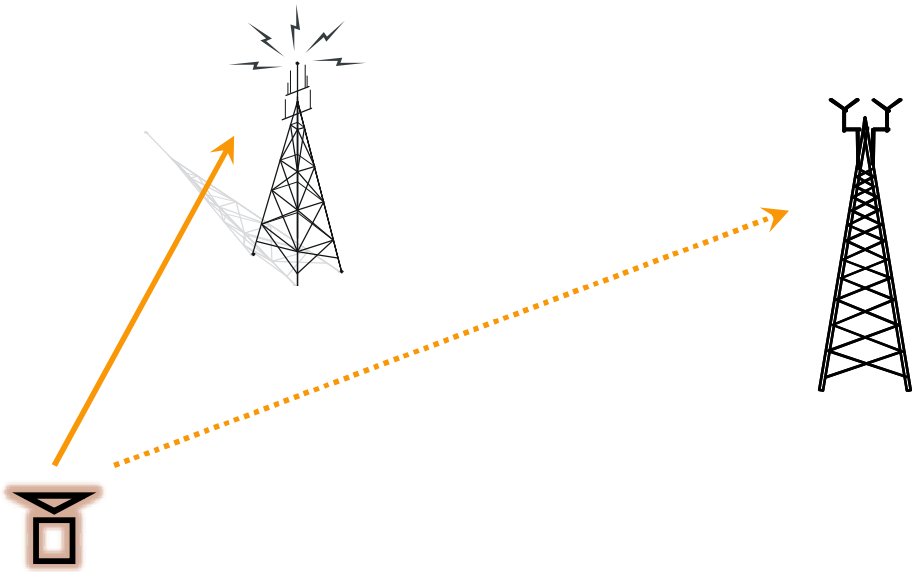
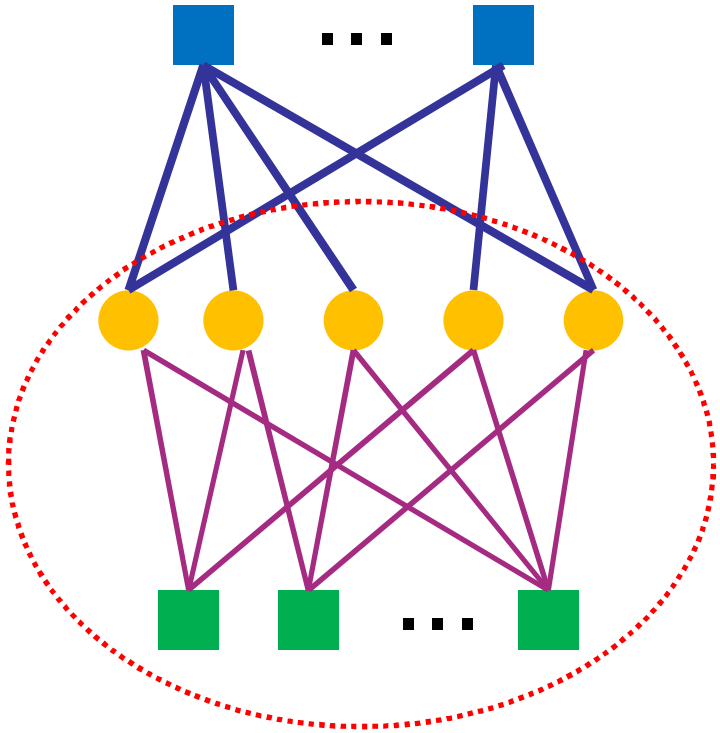
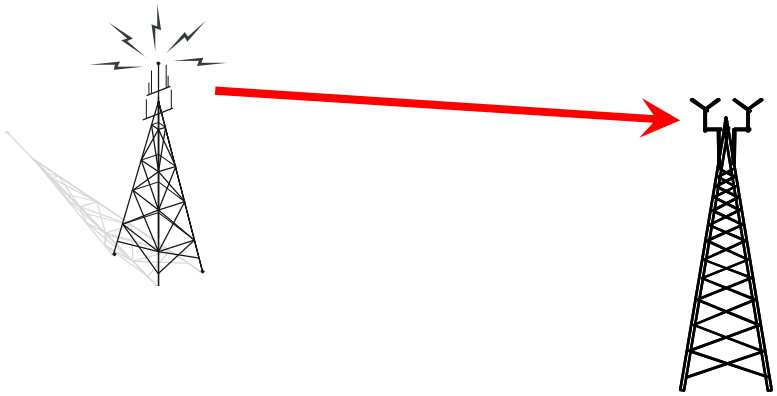
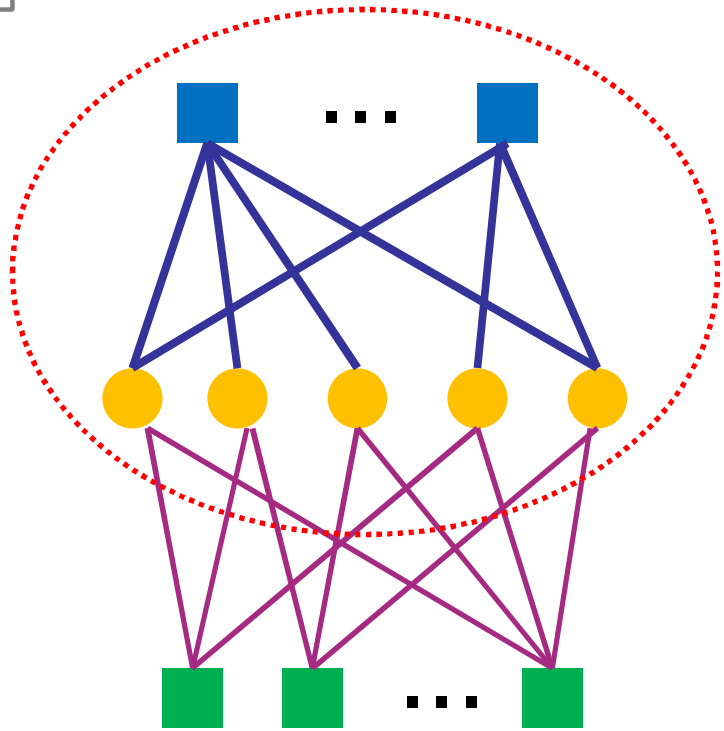
Bilayer LDPC codes for relay channel



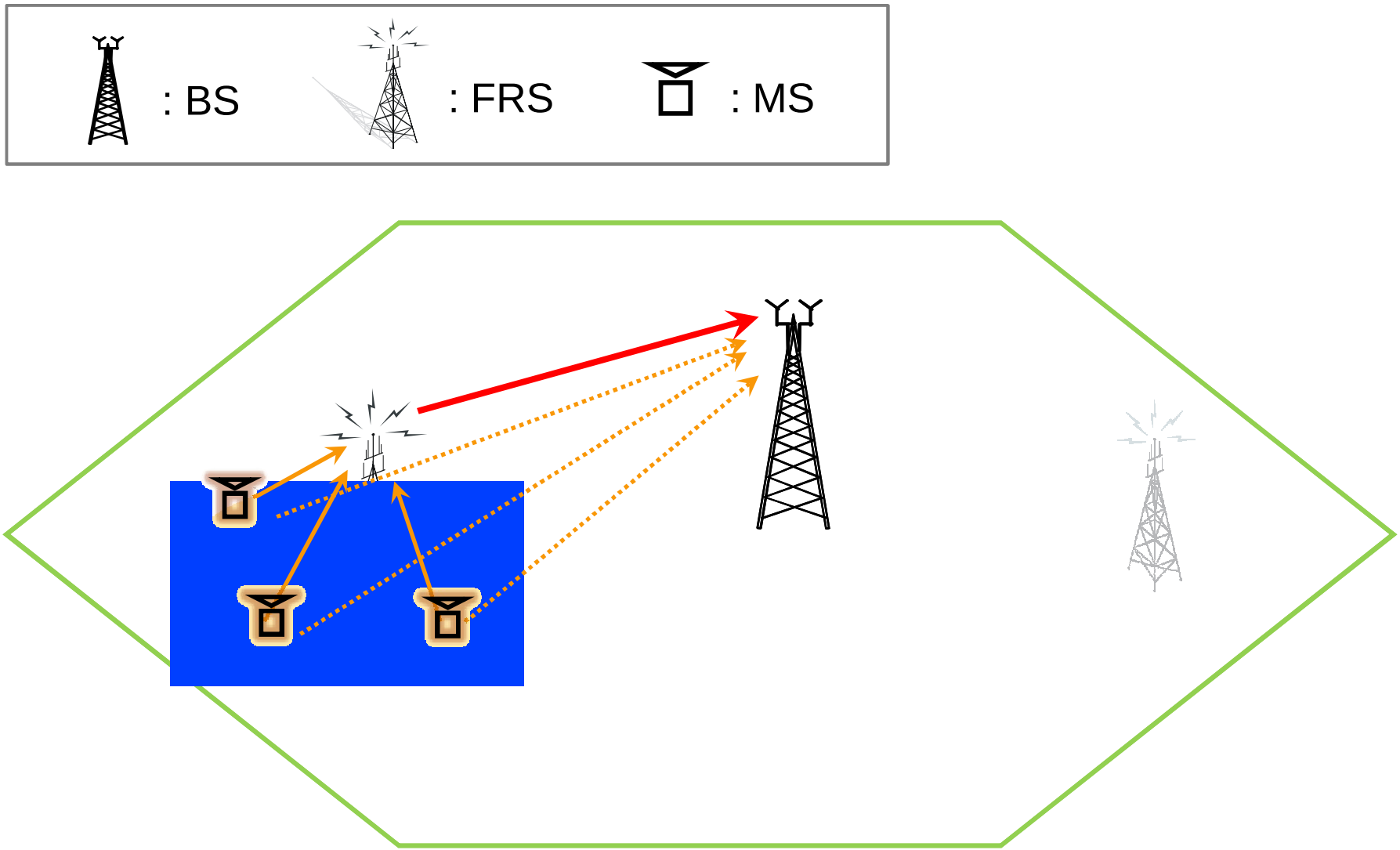


Bilayer LDPC codes for relay channel



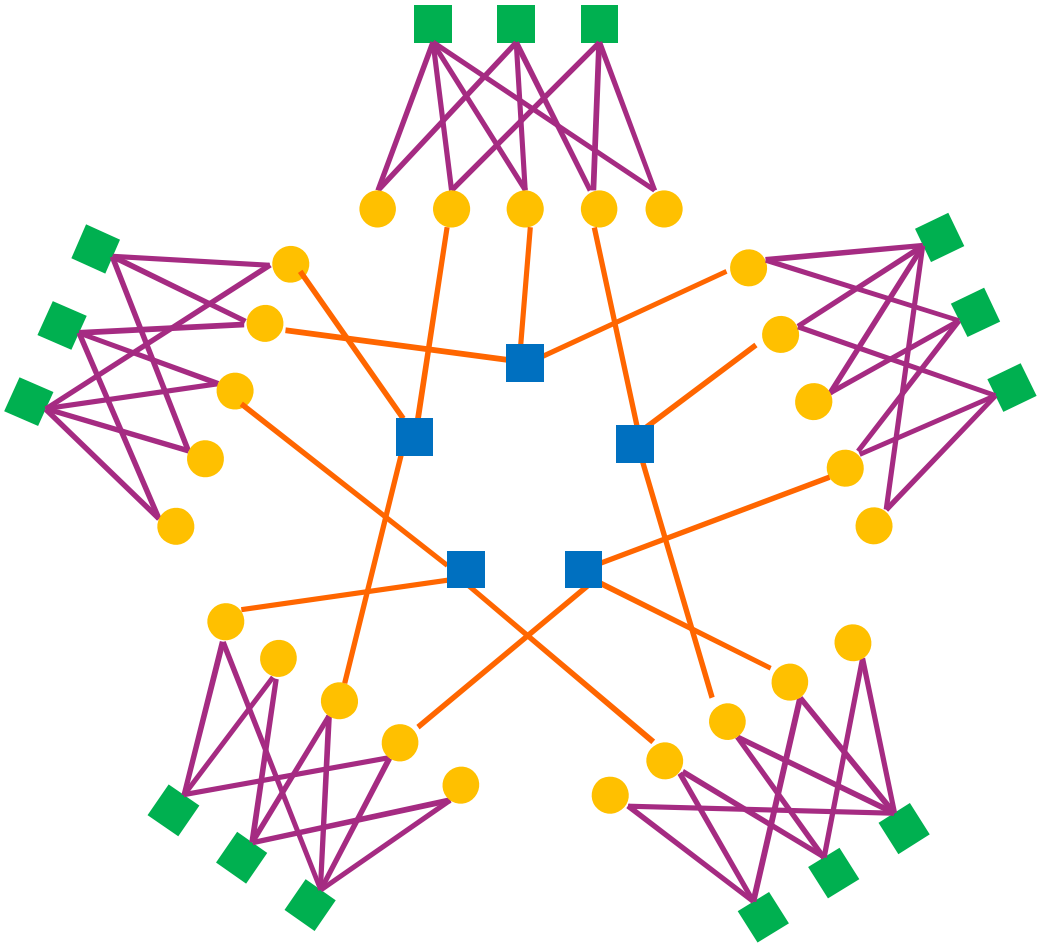


Joint LDPC codes for multiuser relay channel

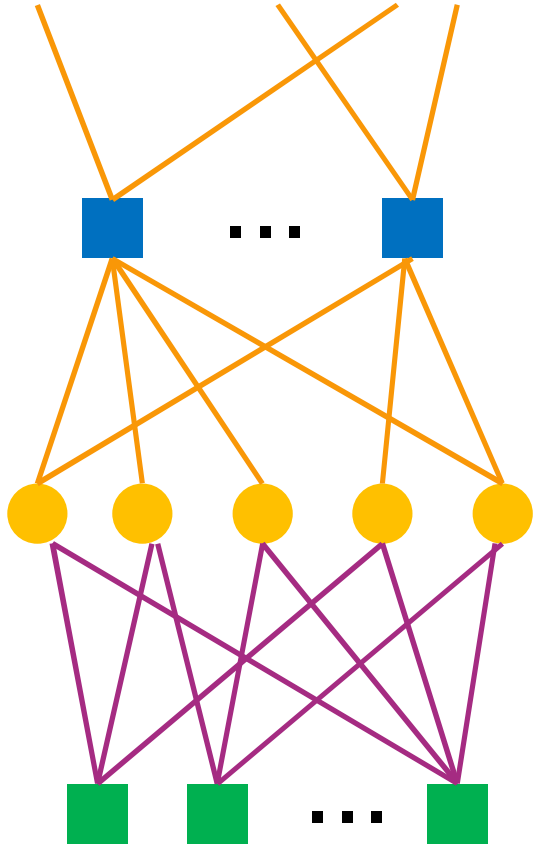


Joint LDPC codes for multiuser relay channel

Overall code graph



Single user code graph



Optimization of Joint LDPC codes

By density evolution for Joint LDPC codes

$$\max_{\lambda_{i,j}} \; R = 1 - \frac{\sum_{u\geq 1}\sum_{i\geq 2}\rho_{i(u)}/i(u)}{\sum_{u\geq 1}\sum_{i\geq 2}\lambda_{i(u)}/i(u)},$$

$$\text{s.t.} \sum_{i\geq 2, j\geq 0} \lambda_{i,j}\left(\frac{i}{i+j}e^1_{i,j}(p^l,q^l) + \frac{j}{i+j}e^2_{i,j}(p^l,q^l)\right) < \mu_h(\eta p + (1-\eta)q)),$$

$$\sum_{i(u)\geq 2} \lambda_{i(u)} e_{i(u)}(p) < \mu_h p,$$

$$\text{where } \lambda_{i(u)} = \frac{1}{\eta(u)} \sum_{j(u)\geq 0} \frac{i(u)\cdot\lambda_{i(u),j(u)}}{i(u)+j(u)},$$

$$err^{l_{max}}(u) \leq err_{th},$$

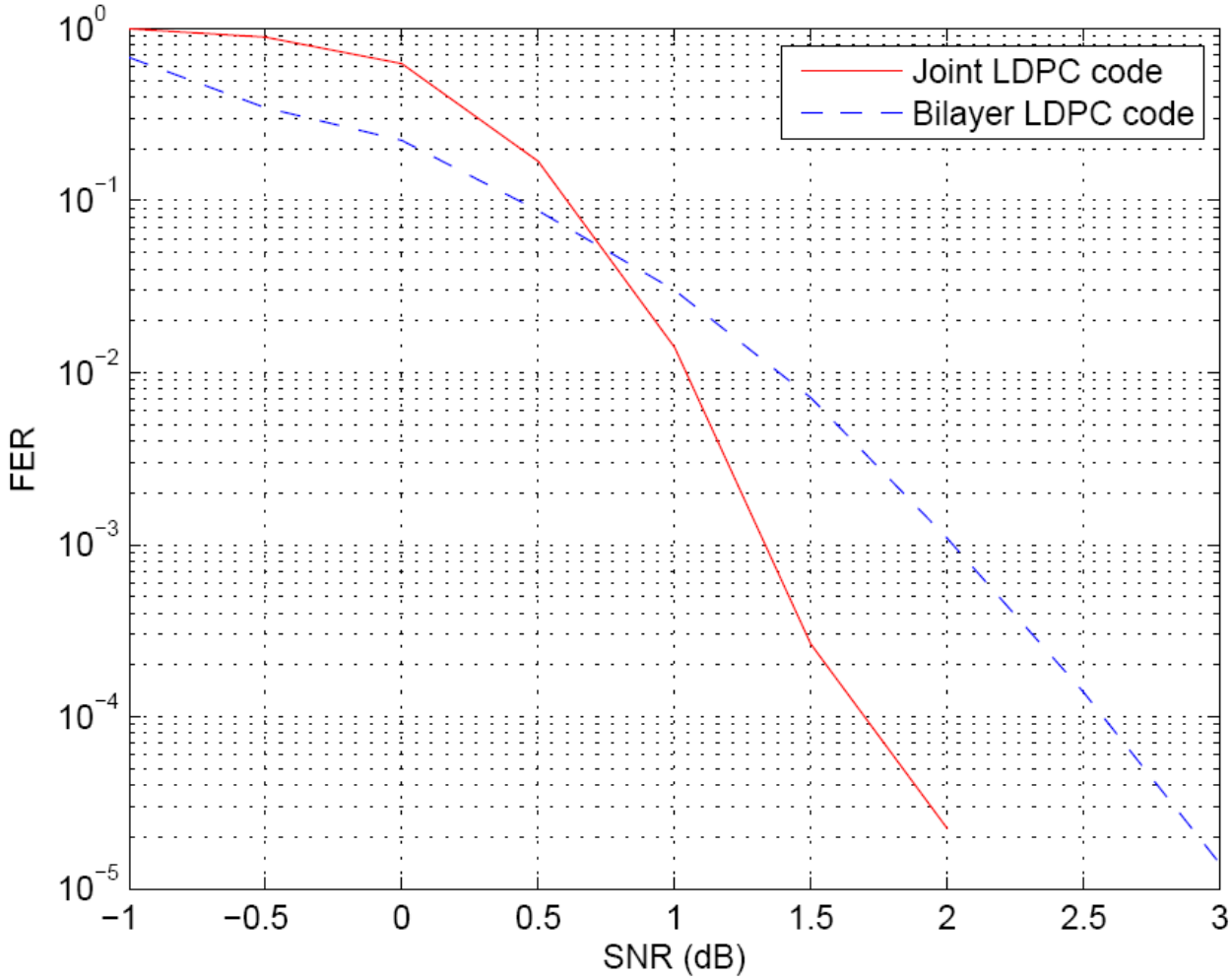
Performance of Joint LDPC codes

Simulation environment

Parameter	Value
Channel	AWGN
Number of Users	12
Overall Code Length	2304
Single User Code Length	96
Code Rate	$R_{SR \text{ or } SD}=2/3$, $R_{RD}=1/2$
Maximum iteration	8

Performance of Joint LDPC codes

FER comparion of Joint LDPC code vs. Bilayer LDPC code



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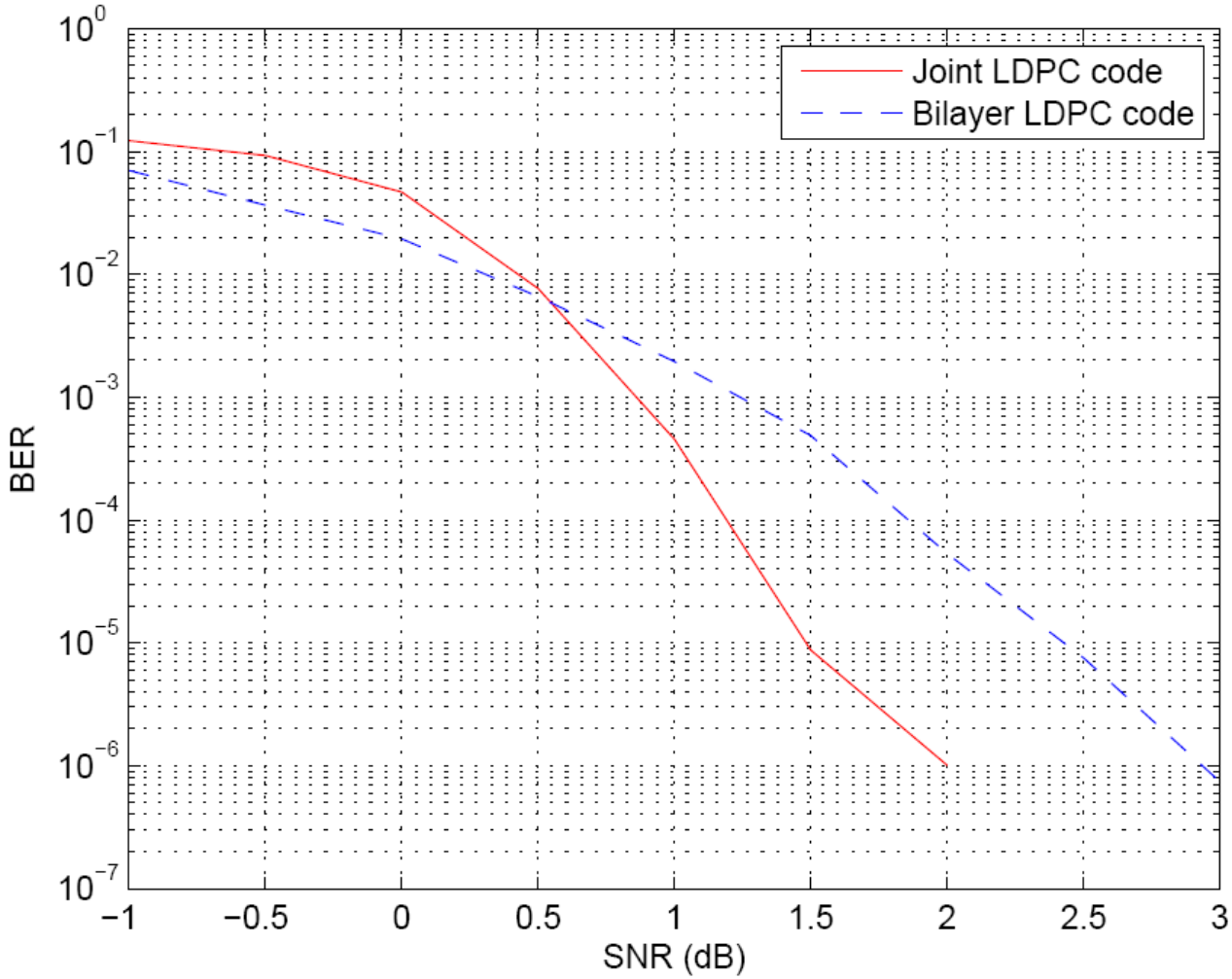

Conclusion

Merits :

Joint LDPC codes bring remarkable performance gain by user cooperation

Joint LDPC codes guarantee achieved service quality by controlling the degree distribution

Demerits :

The relay must be much more intelligent than before

Overall code length decoded simultaneously at the destination becomes much larger than before