Poster corresponding to:
Villez, K., Corominas, L., Vanrolleghem, P. A. (2013). Structural observability and redundancy classification for sensor networks in wastewater systems. Proceedings of the 11th IWA conference on instrumentation control and automation (ICA2013), Narbonne, FR, Sept. 18-20, 2013, Appeared on USB-stick (IWA-12741).

eawag aquatic research

Structural observability and redundancy classification for sensor networks in wastewater systems

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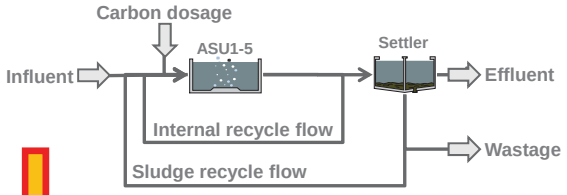
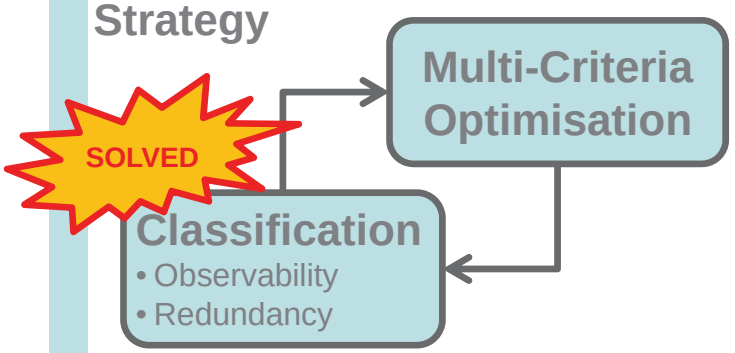
Motivation:
Optimal sensor placement

- Minimum cost sensor network
- Maximize information (observability)
- Fault identification (redundancy)

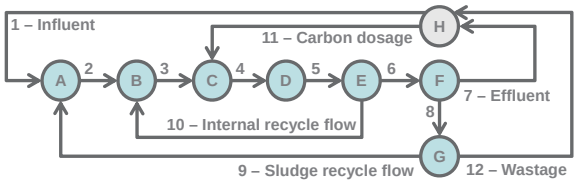
Case study: BSM plant layout



Strategy



Graph-theoretic analysis



Important concepts:

- Cutsets (sets of separating arcs)
- Cycles (closed loops of arcs)

Analysis results
Observability and Redundancy

Measurement
Observable/Redundant
Non-Observable/Non-Redundant

Flow index	Measurement		Observable?		Redundant?	
	Flow rate	TSS	Flow rate	TSS	Flow rate	TSS
1	■		■	■	■	
2			■	■		
3			■	■		
4			■	■		
5		■	■	■		■
6			■	■		
7	■		■	■	■	
8			■	■		
9			■	■		
10			■	■		
11	■	■	■	■	■	■
12	■	■	■	■	■	■

Flow index	Measurement		Observable?		Redundant?	
	Flow rate	TSS	Flow rate	TSS	Flow rate	TSS
1	■		■	■	■	
2			■	■		
3			■	■		
4			■	■		
5		■	■	■		■
6			■	■		
7	■	■	■	■	■	■
8			■	■		
9	■		■	■	■	
10			■	■		
11	■	■	■	■	■	■
12	■	■	■	■	■	■

Flow index	Measurement		Observable?		Redundant?	
	Flow rate	TSS	Flow rate	TSS	Flow rate	TSS
1	■	■	■	■	■	■
2			■	■		
3			■	■		
4			■	■		
5		■	■	■		■
6			■	■		
7	■	■	■	■	■	■
8			■	■		
9	■		■	■	■	
10	■		■	■	■	
11	■	■	■	■	■	■
12	■	■	■	■	■	■

Take home message

- **Efficient algorithms for observability and redundancy evaluation exist**
- **To be tested for automated selection with global optimization techniques**

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