Control Under Partial Observation

- So far assumed complete observation of events is possible for supervisor
- Partial observation due to lack of sufficient number of sensors or presence of faulty sensors
- Partial observation can be modeled using "observation mask" over events:

$$M: \Sigma \longrightarrow \Delta \cup \{\varepsilon\}$$

$M(\sigma) = \varepsilon \Rightarrow \sigma$ is unobservable, corresponding sensor does not exist

$M(\sigma_1) = M(\sigma_2) \Rightarrow \sigma_1$ and σ_2 are indistinguishable, sensors are faulty.

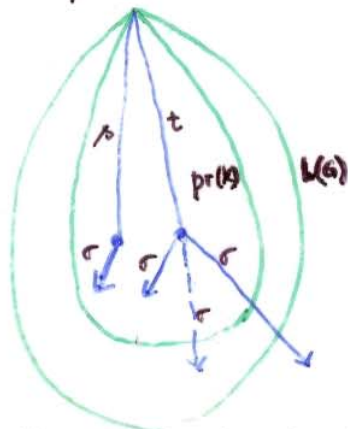- Observation-compatible supervisor: Identical control action following indistinguishable pair of traces.

Formally, $M(s) = M(t)$, $s\sigma \in L(G\|S)$, $t\sigma \in L(G) \Rightarrow t\sigma \in L(G\|S)$.

s, t indistinguishable, σ enabled after s, σ can occur after $t \Rightarrow \sigma$ enabled after t.

- Observation-compatibility or M-compatibility of supervisor imposes additional restrictions on achievable closed-loop behavior:

- Observability (of language K):

$s, t \in pr(K), M(s) = M(t), s\sigma \in pr(K), t\sigma \in L(G) \Rightarrow t\sigma \in pr(K)$

- S is M-compatible iff $L(G\|S)$ is observable.