Towards Seamless Reactivity of Hybrid Control

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full paper on arXiv

simulation on an example

Non-linear Continuous Dynamical System

Logical context switches + Physical disturbances

Temporal Logical Specification

Lower Physical Layer

physical control loop

physical condition ⇄ physical controller

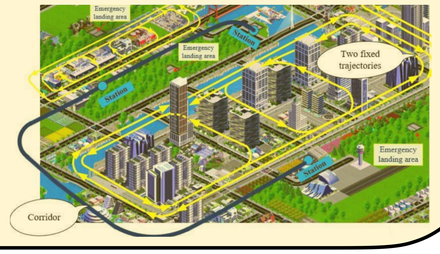
control engineering
certified automatic physical control

Higher Logical Layer

logical control loop

logical context ⇄ logical controller ⊨ logical specification

formal methods
certified logical decision making

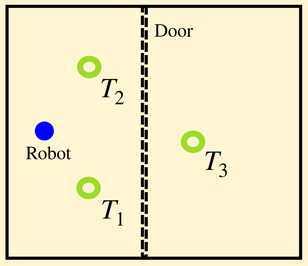


High Level Logical Synthesis

logical behavioural assumption Φ_A

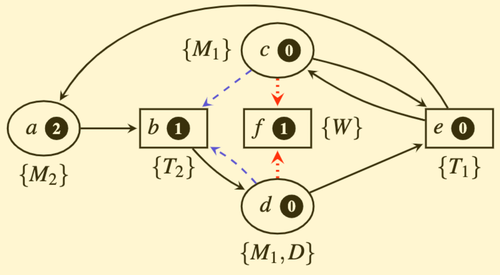
system guarantee

$$\Phi_G = \Box\neg W \bigwedge_{i=1,2,3} (\Diamond\Box M_i \Rightarrow \Diamond\Box T_i)$$



logical specification → initial game → strategy template

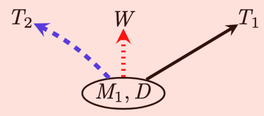
$\Phi_A \implies \Phi_G$



$\text{Unsafe}(e_{cf}, e_{df}) \wedge \text{Colive}(e_{cb}, e_{db})$

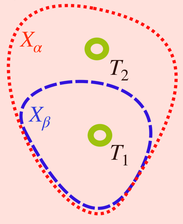
Top-Down Interface

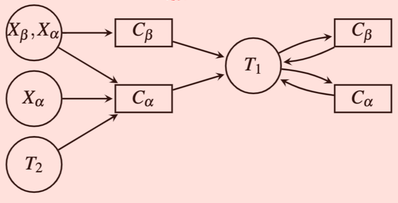
reach-while-avoid problems → control Lyapunov functions → control graph



α : context$(M_1, D) \implies$ reach (T_1) while avoid (W)

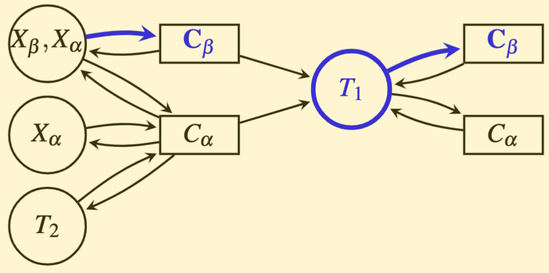
β : context$(M_1, D) \implies$ reach (T_1) while avoid (W, T_2)





Bottom-Up Interface

augmented game graph → final augmented game → hybrid feedback controller



= initial game ⨯ augmented game graph

that actuates a switching strategy for the underlying feedback controllers C_α, C_β, etc.