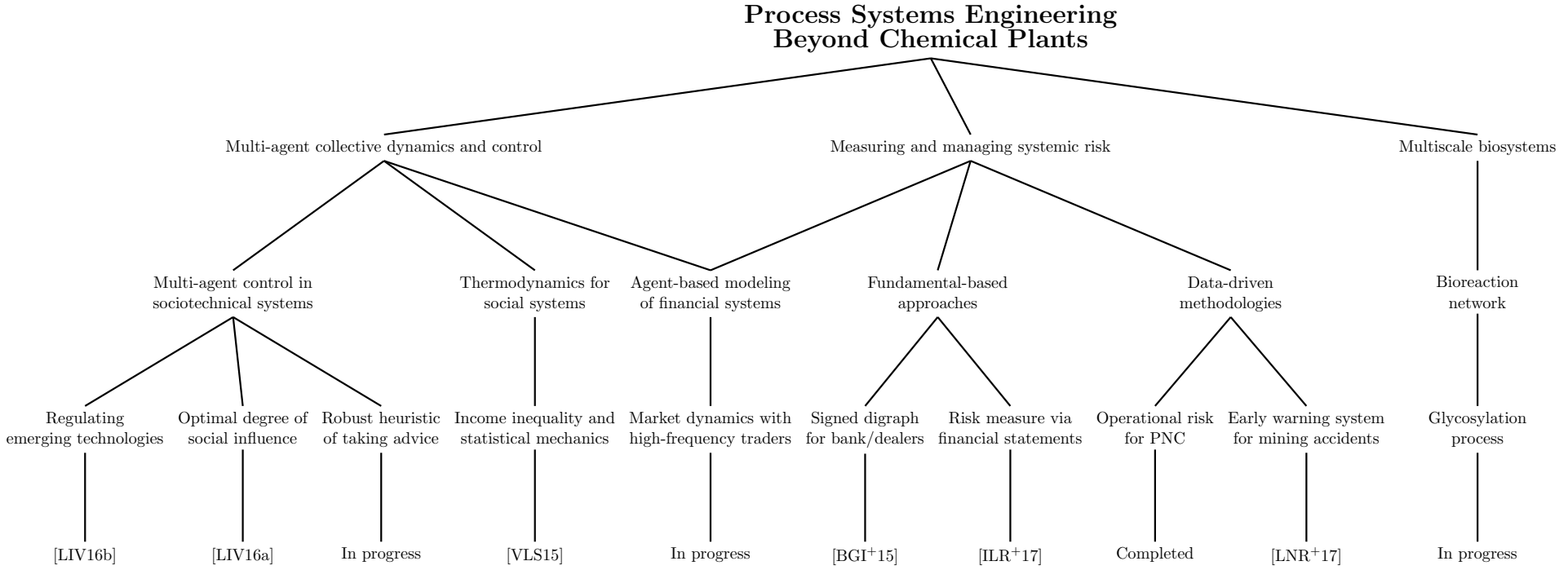

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Multi-Agent Control in Sociotechnical Systems

Open loop dynamics

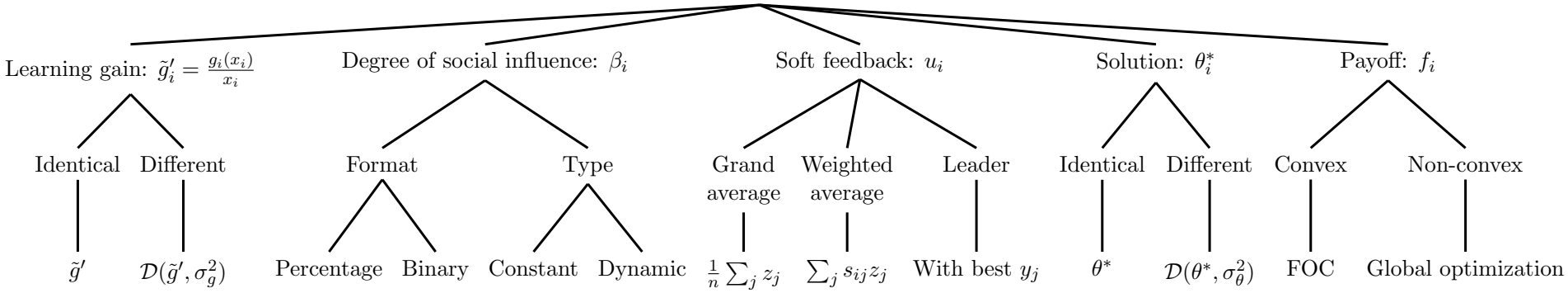
$$z_i(t+1) = g_i\big(z_i(t)\big) + \omega_i(t)$$

Closed loop dynamics

$$\begin{aligned} z_i(t+1) &= (1-\beta_i)\Big(g_i\big(z_i(t)\big) + \omega_i(t)\Big) + \beta_i u_i(t) \quad (i = 1, \dots, n), \\ x_i(t) &= z_i(t) - \theta_i^*, \\ y_i(t) &= f_i\big(x_i(t)\big) + \nu_i(t). \end{aligned}$$

Soft Regulation

Multi-Agent Control with Soft Feedback



Existing examples

Scenario	Learning function	Social influence	Soft feedback	Solution	Payoff
Particle swarm optimization	Local best	$[0, 100\%]$	Leader	Identical	Non-convex
James-Stein estimator	LMS estimator	$[0, 100\%]$	Grand average	Different	Squared error
Social learning	Asocial learning	$\{0, 100\%\}$	Leader	Identical	Non-convex
Wisdom of crowds	-	-	Grand average	Identical	-
Collective dynamics	-	100%	Weighted average	-	-