

Speaker: Tomasz Kowalski (joint Work with Guillermo Badia, Daniel Găină, Alexander Knapp and Martin Wirsing)

Title: Hybrid-Dynamic Ehrenfeucht-Fraïssé Games

Abstract: Ehrenfeucht-Fraïssé games provide means to characterize elementary equivalence for first-order logic, and by standard translation also for modal logics. We propose a novel generalization of Ehrenfeucht-Fraïssé games to hybrid-dynamic logics which is direct and fully modular: parameterized by the features of the hybrid language we wish to include, for instance, the modal and hybrid language operators as well as first-order existential quantification. We use these games to establish a new modular Fraïssé-Hintikka theorem for hybrid-dynamic propositional logic and its various fragments. We study the relationship between countable game equivalence (determined by countable Ehrenfeucht-Fraïssé games) and bisimulation (determined by countable back-and-forth systems). In general, the former turns out to be weaker than the latter, but under certain conditions on the language, the two coincide. As a corollary we obtain an analogue of the Hennessy-Milner theorem. We also prove that for reachable image-finite Kripke structures elementary equivalence implies isomorphism.

Relevant paper: Guillermo Badia, Daniel Găină, Alexander Knapp, Tomasz Kowalski and Martin Wirsing, Hybrid-Dynamic Ehrenfeucht–Fraïssé Games, ACM Transactions on Computational Logic, 2025, <https://arxiv.org/abs/2406.02094>