https://equiv.io

Generalized Equivalence Checking of Concurrent Programs

We study the spectroscopy problem that asks which notions from a spectrum of behavioral equivalences relate a pair of states in a transition system. This allows a generalized handling of questions on how equivalent two programs are.

As main result, we solve the spectroscopy problem for finite-state systems and a hierarchy of semantic models known as the weak linear-time–branching-time spectrum, due to van Glabbeek. The spectrum arises because of different ways of understanding nondeterminism and internal behavior in models of concurrent programs. We also treat the strong spectrum (without internal behavior) as well as use cases of generalized equivalence checking in verification and concurrency theory.

Our approach relies on a quantitative understanding of spectra in terms of how many syntactic features of Hennessy–Milner modal logic are used to characterize equivalences. As key trick to tackle the spectroscopy problem, we prove spectra of equivalence to be captured by spectroscopy games where energy budgets bound the features an attacker may use to express differences of states.

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