Ready Simulation Equivalence as a Global Bisimulation

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Abstract

Bisimulations are a rather natural way to define an equivalence relation between non-deterministic systems. They can be defined in a simple way using coinductive methods, and have rather pleasant properties. Nevertheless it has been argued many times that bisimulation equivalence is too strong, so that it becomes a non too flexible way to prove the (natural) equivalence between processes. In particular, ready similarity was proposed by Meyer et al. [BIM95] (also by Larsen and Skou [LS91] in a probabilistic context) as a way to weakening the bisimulation equivalence thus getting a semantics defined in a similar way, but supported for more reasonable observational properties.

In [dFLN99] an equivalence coarser than the weak timed bisimulation is proposed in which the internal choice operator becomes associative. To achieve this goal *global bisimulations* were introduced. They are defined as plain bisimulations but allowing the use of new moves, called global transitions, that can change the processes not only locally in its head but everywhere.

Now we are continuing the study of global bisimulation but focusing on the way different semantics can be characterised by means of a global bisimulation semantics, taking the adequate notion of global transition that characterise the identifications made by the considered semantics. In particular we have studied ready similarity, on the one hand because it was proposed as the strongest reasonable semantics weaker than bisimulation, and this means that the distance between it and plain bisimulation it is not large; on the other hand because ready similarity was not directly defined as an equivalence relation but as the nucleus of an order relation, and this open the question whether it is also possible to define it as a symmetric bisimulation-like semantics.

Covering our expectations we have got a simple and thus very nice characterisation of ready similarity as a global bisimulation semantics, that provides, as a byproduct, a direct symmetric characterisation of it as an equivalence relation without using any ordering as intermediate concept. Besides, with this case study we have learned a lot about global bisimulations. In particular we have found that we do not need to start from a simulation based semantics to get an equivalent global bisimulation, in an easy way. Instead, what proved to be very useful was the axiomatic characterisation of the semantics, and in fact we have seen that starting from the characterisations given by van Glabbeek [Gla01] we can also get nice presentations of refusal, trace semantics and many other, thus having a general framework that allows to relate intensional and extensional semantics in a very nice way, that we are currently exploring [dFG04].

References

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