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# Information and Computation

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## Preface

### Intuitionistic Modal Logic and Applications (IMLA 2008)

Intuitionistic modal logics and type theories are of increasing foundational and practical relevance in computer science and in logic. Intuitionistic modal logic is a truly multi-disciplinary field that studies modal logics based on constructive principles. Logicians and philosophers were the first to consider the interesting possibilities afforded by mixing modal operators with a constructive perspective. But soon enough computer scientists joined in, especially interested in extending type theories with modalities, to obtain modal versions of the Curry–Howard correspondence.

Applications of intuitionistic modal logics concentrate in type disciplines for programming languages, and in meta-logics for reasoning about a variety of computational phenomena. Theoretical and methodological issues center around the question of how the proof-theoretic strengths of constructive logics can be best combined with the model-theoretic strengths of modal logics. Practical issues center around the question of which modal connectives (with associated laws or proof rules) can capture which computational phenomena accurately and at the right level of abstraction.

A series of workshops on Intuitionistic Modal Logic and Applications (shortened to IMLA) has been organized by researchers interested in the field. Previous workshops called IMLA were held as part of the Federated Logic Conference, FLoC 1999, in Trento, Italy, of FLoC2002, in Copenhagen, Denmark, as an associated meeting to Logic in Computer Science, LiCS2005, in Chicago, USA and of LiCS2008, in Pittsburgh, USA. Collections of articles associated to the subject have appeared as *Modalities in type theory* by Fairtlough, Mendler and Moggi, special issue of *Mathematical Structures in Computer Science*, 2001 and *Intuitionistic Modal Logic and Application*, guest editors Goré, Mendler and de Paiva, 2004, special issue of the *Journal of Logic and Computation*, where a long preface introduces some of the lines of research in the area, up to that time.

After the workshop in 2008 it was decided that a new volume, collecting some of the work presented in the workshops in 2005 and 2008 was a good idea. An open call for papers was sent out with a deadline in May 2009 and in this volume we have the product of that call for papers. Keeping up with the high standards of *Information and Computation*, of the 14 papers originally submitted only six were accepted. The papers on this volume cover some of the breadth of the research in intuitionistic logics and type theories, but inevitably some good work did not make it, as it had either been published already or is still been developed.

This special issue begins with a survey on intuitionistic hybrid logic by T. Brüner. Hybrid logics, where the worlds of the models, as well as the satisfaction relation, are made part of the logic's language itself, instead of its metalanguage, are a new and growing development in modal logics. The research field of hybrid logics has grown strong over the past few years as seen by the increasing number of conferences and publications in this area. Among the work considering an intuitionistic version of hybrid logics, this issue includes the contribution of Galmiche and Salhi, which provides a sequent calculus for an intuitionistic hybrid logic system and proves its decidability. The work by Mendler and Scheele investigates a new hypersequent presentation of the possibility operator in intuitionistic modal logic where the possibility operator, usually denoted by  $\diamond$ , does not distribute over disjunctions  $\diamond(A \vee B) \rightarrow \diamond A \vee \diamond B$  in binary or  $(\diamond \perp \rightarrow \perp)$  nullary versions. The failure of the nullary version is usually associated with the need for fallible worlds, that is worlds where every proposition is provable.

The paper by Kojima and Igarashi takes a more applied stance, starting from their desire to deal with multistaged programming, but in fact is using a system very much like Mendler and Scheele's where the distributivity of the modality over disjunction is not satisfied. Kojima and Igarashi denote their modality by a circle, and think of it as the “next” operator in temporal logic. The paper by Hermida brings in a new perspective, investigating transition systems (a computer science name for possible worlds) from a higher-order categorical logic perspective. Finally the paper by Park and Im introduces a new constructive modality, which internalizes the notion of *normal proof* in a logical system. As can be seen from this small sample, work in intuitionistic modal logics and type theories can be very challenging to classify, as it goes in many different directions.

The guest editors would like to thank all the authors of the papers presented at both IMLA2005 and IMLA2008, as well as the authors of all the submitted papers for their effort and their contributions to the discussion of constructive modal logics. We also would like to thank our reviewers who provided extensive feedback on the submitted papers. In particular,

we would like very much to thank Aleks Nanevski for all the help he provided with the organization of the meetings and of this special volume.

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Available online 14 October 2011

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