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Summary of the PhD thesis

Semantical investigations of fragments of Intuitionistic Control Logic

We investigate fragments and properties of Intuistionistic Control Logic, which was introduced by Ch. Liang and D. Miller and could be seen as a combination of intuitionistic and classical logics. It arises from Intuitionistic Propositional Logic by extending its language with additional new constant for falsum, denoted by $\bot$, which is distinct from intuitionistic falsum denoted by 0. Having two different falsum constants enables to define two distinct negations: an ordinary intuitionistic negation denoted $\sim \phi := \phi \to 0$ and a new negation $\neg\phi := \phi \to \bot$ which bears some characteristic of classical negation.

In Chapter 1 we recall fundamental definitions and theorems concerning Intuitionistic Propositional Logic as throughout the thesis we put Intuitionistic Control Logic in the perspective of intuitionistic and classical logics.

Chapter 2 opens with semantical and proof-theoretic description of Intuitionistic Control Logic. The original impetus for Intuitionistic Control Logic came from the search for a logic that would preserve the crucial connective of intuitionistic implication and at the same time would be able to type programming language control operators. It is achieved via new negation $\neg\phi$ which results in a question about the strength of the monadic negational fragment of Intuitionistic Control Logic. We analyse the number of distinct operators that can be defined by sequences of both negations and give the complete characterisation of the interaction between them by presenting a poset of nonequivalent formulas of this fragment. Furthermore we investigate monadic fragment of Intuitionistic Control Logic in the language without intuitionistic falsum and present the lattice of all nonequivalent formulas in this fragment.

In Chapter 3 we consider the modal companion for Intuitionistic Control Logic. This notion is known in the case of intermediate logics. Intuitionistic Control Logic does not belong to the class of intermediate logics as it arises by extending the language of Intuitionistic Propositional Logic and not by adding new axioms. Nevertheless it is possible

to embed Intuitionistic Control Logic into some modal logic. We show that in particular Intuitionistic Control Logic can be embeded into a modal quantified propositional logic which is defined by the class of finite trees with irreflexive root. Thus defined logic is not a priori decidable. We show that in fact it can be interpreted in the monadic second order theory $\mathsf{S}\omega\mathsf{S}$, which implies its decidability.

References

[1] A. Glenszczyk, Negational Fragment of Intuitionistic Control Logic, *Studia Logica*, 103 (6), 1101–1121, 2015.

[2] A. Glenszczyk, Monadic Fragments of Intuitionistic Control Logic, *Bulletin of the Section of Logic*, 45(3/4), 143–153, 2016.

[3] Ch. Liang, D. Miller, An Intuitionistic Control Logic, to appear.

[4] Ch. Liang, D. Miller, Unifying Classical and Intuitionistic Logics for Computational Control, Proceedings of LICS 2013.

[5] Ch. Liang, D. Miller, Kripke Semantics and Proof Systems for Combining Intuitionistic Logic and Classical Logic. *Ann. Pure Appl. Logic*, 164 (2), 86–111, 2013.