

Call for participants: Open Online Course

(Every Thursday from 2021/05/06 to 2021/07/29)

Model Theory: mathematical foundations for specification languages

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受講生募集中: オンラインZoom講義 (5月13日~7月29日 (毎週木曜日 16:00-18:00))

モデル理論 : ソフトウェアの代数的仕様記述と形式検証

Abstract: The course is an introduction to model theory: a branch of mathematics that deals with the classification of structures by means of logical formulas. Mathematical structures (groups, rings, fields, ordered sets, lattices, and others) can be classified according to the logical formulas that are true in them. Conversely, given some logical formulas, one wants to find classes of structures in which the formulas are true. We call those structures 'models' of the formulas; moreover, when M is the class of all models of a set F of formulas, we say that F is a 'theory' of M ; hence, the name of model theory. Historically, mathematicians have used models all the time, they just did not build a theory around it. For example, to demonstrate that Euclid's fifth postulate does not follow from the rest, one can take a sphere: a (non-standard) model of all the postulates except the fifth. Model theory however is relatively young, it did not exist before the second half of the 20th Century.

In addition, this course provides the foundations of software specification and formal verification of systems from the perspective of the work on algebraic specification. It also introduces some basic concepts necessary for the design of an algebraic-specification language. One important characteristic of the present course is the use of many-sorted first-order structures (instead of single-sorted structures), which consist of collections of sets (of data values) together with functions and relations over those sets. Another important feature is that we will consider first-order structures with empty carrier sets following Wilfrid Hodges' approach in *A Shorter Model Theory*, thus allowing for higher mathematical flexibility on the objects our logical languages describe. Many-sorted first-order structures can be regarded as models of concrete software systems. Therefore, we can learn a lot about software systems by analyzing their model theory. This abstraction corresponds to the view that the correctness of the input/output behaviour of a software system takes precedence over other properties such as efficiency.

Note: The starting day is 13th of May (16:00-18:00) ! The first four lectures will be delivered from W1-D-710. Please feel free to attend and ask questions face-to-face. At the same time, everything will be made available online via Zoom.

Lecture materials

<https://moodle.s.kyushu-u.ac.jp/course/view.php?id=36214>

<https://imi.kyushu-u.ac.jp/~daniel/model-theory/model-theory.html>

Contact:

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