

Imperative Knowledge Representation with PyIRK

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The semantic web as a concept was introduced more than 20 years ago. Nevertheless, compared to numerical AI (neural networks) the usage of semantic technologies (aka symbolic AI) in the mathematics-based sciences, including engineering, is still not widespread. In this talk we briefly evaluate existing technologies like RDF, OWL, Wikidata and ORKG for modeling mathematical knowledge such as definitions and theorems. We then present PyIRK –a Python based framework for imperative representation of knowledge. The basic idea is to leverage the flexibility of a full-fledged programming language to formalize complex knowledge structures such as setting, premise and assertion of theorems with moderate effort while at the same time allowing for SPARQL queries and rule based reasoning. We further present the application of this approach to implement the Ontology of Control Systems Engineering (OCSE) by discussing the modeling of concepts and theorems from Lyapunov theory as examples. Finally, we also give an insight in our current attempt to leverage large language models to extract mathematical knowledge from LaTeX source code and transform it into PyIRK.

Author: KNOLL, Carsten (TU Dresden)

Co-author: FIEDLER, Julius (TU Dresden)

Presenter: KNOLL, Carsten (TU Dresden)

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