

TS4MathModDB: When the Owl meets the Wikibase - Keeping two Worlds in Sync

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Abstract:

Knowledge graphs increasingly need to serve different communities at once: researchers and data scientists who require formal logical rigor and reasoning capabilities, and open, community-driven platforms that thrive on accessibility and collaborative curation. MathModDB, a research knowledge graph for mathematical models developed within the Mathematical Research Data Initiative (MaRDI), lives in exactly this tension. It originated as a formally modelled OWL ontology and today exists as a Wikibase-powered knowledge graph embedded in the MaRDI portal. The presentation highlights how TS4MathModDB, the incubator project of TS4NFDI and MaRDI, helps to keep the two distinct technical and conceptual worlds of knowledge graphs synchronized.

This dual existence is not a design flaw but a response to a real disciplinary challenge: mathematicians and domain experts may rely on OWL's structural guarantees, domain and range constraints, and automated reasoning to model mathematical semantics correctly, while the broader NFDI community needs a platform with a low barrier to entry, built-in versioning, and seamless interlinking with a vast ecosystem of Linked Open Data, provided by the Wikibase technology stack. Without a coordinated effort, however, these two representations risk drifting apart as one evolves independently of the other, undermining the very interoperability NFDI services are meant to provide.

TS4MathModDB, a TS4NFDI incubator project, was established to address this challenge directly. A steady-state release of MathModDB (version 1.0.0, February 2025), based solely on the OWL ontology file rather than the MaRDI portal, has already been integrated into the

TIB Terminology Service. The project's central objective is to fully integrate MathModDB into the TS4NFDI terminology service while keeping MathModDB on the MaRDI portal as the master copy, and to establish mechanisms that keep the OWL-based ontology synchronized with this Wikibase-powered master copy. Achieving this requires close collaboration between the MathModDB/MaRDI team and the TS4NFDI base service team, combining domain expertise in mathematical modelling with terminology service infrastructure to design synchronization mechanisms suited to both worlds.

This integration is more than a technical exercise: it directly enables cross-consortia collaboration. One of MaRDI's partnering consortia, NFDI4Bioimage, has already integrated its plasma ontology, Plasma-O, into the TS4NFDI services as a semantic platform for low-temperature plasma science. MathModDB describes several of the models occurring in Plasma-O in far greater mathematical detail. Interlinking the two via the TS4NFDI mapping service transforms MathModDB within the terminology service from a standalone mathematical resource into shared infrastructure across disciplinary boundaries. We argue that this kind of synchronization work, though often invisible, is essential infrastructure for research knowledge graphs that must live across multiple technological worlds and a prerequisite for cross-consortia reuse.

Keywords: knowledge graph, mathematical research data, terminology service, ontology