

**Title:** Functional Meta-Languages for Hardware Design

**Abstract:** The concept of embedding a Hardware Description Languages (HDLs) within a general purpose functional language has been widely researched. Various implementations, like Lava and Hydra, have shown amongst other benefits, the levels of abstraction that can be achieved, such as the description of parametrised circuit generators, which enable the description of generic circuits. This environment provides a two-stage language setting, enabling to reason about the generated circuits as data objects within the host language itself. Nonetheless, the generated circuit objects are completely detached from their generators, and therefore lack information which could have otherwise been used to provide placement hints or other analysis. We present a HDL built using reFLect, a functional language with reflection features, which enable not only to access the generated circuits, but also the circuit generators, allowing us to add non-functional properties to the circuits such as markings of the hierarchical modules, and placement information. Furthermore, we propose a framework to formally verify hardware compilers and which minimises user intervention, unlike previous frameworks which allowed room for user errors.