

Correct-by-construction synthesis for smart manufacturing

Prof. Hadas Kress-Gazit, Cornell University

Moving from monolithic manufacturing lines and material handling facilities that require considerable time and effort to set up, to flexible and agile processes that can be reconfigured for different products quickly and by non-experts, requires modularity, composition and a language to reason about the overall task. As robotics and automation becomes more capable, with better sensors, better actuation and more data, the basic building blocks that enable smart manufacturing are maturing and questions of composition and higher-level abstractions come into play.

In this talk I will describe recent approaches to automating robot design and programming from high-level specifications. These type of techniques - "synthesis for robotics" - enable novice users to describe at a high-level what a robot should do or accomplish. Synthesis algorithms then either automatically create a correct-by-construction system, or provide feedback to the user regarding what cannot be done. I will describe different specification formalisms, offline and online synthesis algorithms and the types of feedback they can provide. I will show how we have used synthesis techniques in a variety of domains including modular robots, swarms and human-robot interaction.