Dynamic Analyses for Floating-Point Precision Tuning

Cindy Rubio Gonzalez, University of California, Davis

Given the variety of numerical errors that can occur, floating-point programs are difficult to write, test and debug. One common practice among developers is to use the highest available precision. While more robust, this can degrade program performance significantly. In this talk, I will present two dynamic analyses to assist programmers in tuning the precision of their floating-point programs. First, I will present Precimonious, a tool that performs a search on the types of floating-point variables to lower their precision subject to accuracy constraints and performance goals. Second, I will present Blame Analysis, an analysis that performs shadow execution side-by-side with concrete execution to determine, in isolation, the precision requirements of instruction operands for various levels of accuracy. The analysis later propagates precision requirements to produce a global solution given a target instruction and an accuracy constraint. I will present the evaluation of Precimonious, and Blame Analysis. In particular, I will show how combining Blame Analysis and Precimonious leads to more efficient precision tuning (the combined analysis time is 9x faster than Precimonious alone on average).