Implementation of the VAS algorithm in Maxima

Alkiviadis G. Akritas

In this talk we present our implementation of the VAS real root isolation method in the Computer Algebra System Maxima. This was a semester project in the Computer Algebra class of the Department of Electrical and Computer Engineering at the University of Thessaly.

The Maxima programming language is an old one and since it lacks certain features, such as dynamic lists and the statement continue it provided challenges / traps to the students. We describe the interfaces we used, namely TeXmacs, wxMaxima and the standard Terminal, and state their weak points. The end-product is the file VAS.mac that can be downloaded from the site

http://inf-server.inf.uth.gr/ akritas/VAS.mac

VAS.mac can be used both in batch or compiled mode (instructions on the usage can be found inside VAS.mac itself). It should be noted that during the translation/compilation process we discovered three compiler bugs, namely

- http://sourceforge.net/p/maxima/bugs/2569/, as a result of which we used the rat function with only one argument,
- https://sourceforge.net/p/maxima/bugs/2576/, as a result of which we used the function ratdisrep(…) in certain if statements to convert a Canonical Regular Expression (CRE) to a General Expression (GE), and
- the compiler does not like functions names with mixed-case letters, as a result of which we used all lower case names.

For the approximation of the roots we used the function bzero — downloaded from the Maxima archives (for the year 2007) which can be found at the site http://www.math.utexas.edu/mailman/listinfo/maxima — which uses Brent’s algorithm to compute a root within an interval (l, r). The obtained results are exactly the same as those computed with Maxima’s own realroots function.