

Computer Algebra Systems: Multi-Purpose Tools for Science and Engineering

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Abstract

Computer algebra systems (CAS) appeared in the late '60's (!) and were initially developed and fostered by the needs of scientists working in astronomy and high energy physics. The pioneer CAS were *Macsyma* (developed at *Massachusetts Institute of Technology (MIT)*) and *Reduce* (developed by *The RAND Corporation*). The two main characteristics of CAS are:

- the possibility (active by default) to work in exact arithmetic, that is, not to approximate numbers using the built-in floating point arithmetic, like *normal* calculators and computer languages do, but to deal with numbers as usual in mathematics, calculating, for example: $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$ or $\sqrt{6} - \sqrt{3}\sqrt{2} = 0$
- the possibility of handling non-assigned variables, that is, for example, to simplify $(x + y)^2 - (x - y)^2$ to $4xy$ (where x and y haven't been assigned numerical values).

The CAS have evolved along this almost 50 years to huge general purpose CAS (a class dominated by *Mathematica* and *Maple*), with impressive capabilities in most fields of mathematics, and specific purpose small CAS (like *CoCoA* or *Singular*).

We shall give some selected examples of the need for working with CAS when performing scientific computations [1], a brief overview of their capabilities [2], and some specific examples of their potential when applied to engineering [3,4,5].

References

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