

Computation of minimal units monomials

Daniel Lichtblau

Wolfram Research Inc.

In this talk I will consider the following problem. We are given a "units monomial", that is, a product of (possibly negative) integer powers of physical units, e.g. $(meters^2 \times volts)/(farads \times seconds^3)$. We might try to make sense of this by finding all equivalent monomials subject to a minimality condition. Good candidates for such a condition involve minimizing exponents. For example one might minimize the sum of absolute values of exponents, or minimize the larger of the sum of numerator and sum of denominator exponents. Given a set of algebraic relations between pairs of such monomials, we will readily set these up as problems in integer linear programming, and discuss various ways in which it might be solved via algebraic or numeric programming.

This arose in-house several months ago in the context of a web site currently under development at Wolfram Research. Hence the ability to tackle it with reasonable computational efficiency (i.e. in real time) is paramount.