Overview of the *IBEX* library

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IBEX is an open-source C++ library for constraint processing over real numbers [1]. It provides reliable algorithms for handling non-linear constraints. In particular, roundoff errors are also taken into account. It is based on interval arithmetic and affine arithmetic. The main feature of *IBEX* is its ability to build strategies using contractor programming.
The concept of **contractor** is directly inspired by the concept of filtering algorithms in constraint programming [2]. The strength of *IBEX* lies mainly in this concept. Every algorithm in *IBEX* is included as a *Contractor* [1].
Two emblematic problems can be addressed with *IBEX*:

(i) **Systems solving**: A guaranteed enclosure for each solution of a system of (nonlinear) equations is calculated;

(ii) **Global optimization**: A global minimizer of a function under non-linear constraints is calculated with guaranteed and reliable bounds on the objective minimum.

Due to the modularity of this framework, several projects are based on *IBEX* to solve more specific problems:
(1) **DynIbex** offers a set of validated numerical integration methods based on Runge-Kutta schemes to solve initial value problems of ordinary differential equations and for DAE in Hessenberg index 1 form [3].
(2) **ViabIbex** is a software designed to approximate viability kernel of 2D problems [4].
(3) **BubbIbex** proves that a controlled non-linear system always stays inside a time moving bubble [5].
(4) **SynthIbex** synthesizes H_∞ Robust Control Law under structured constraints [6].

Références

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