

Robex : Robotics for exploration

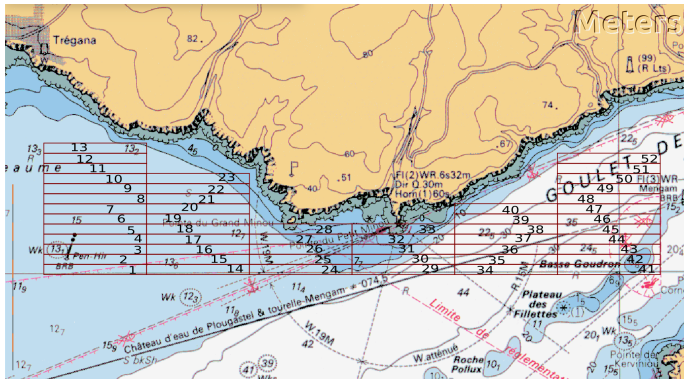
L. Jaulin

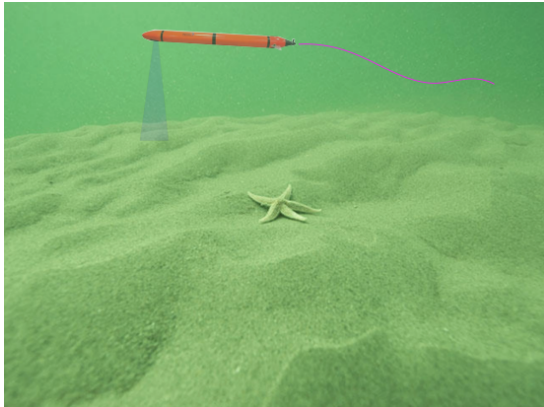
2-3 Mars 2023

Séminaire Lab-STICC, Moulin Mer



1. Marine robots to build maps



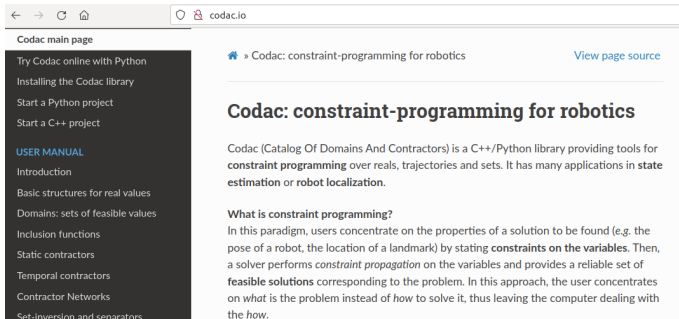


2. Point marquant : codac.io

Given

$$\begin{cases} \dot{\mathbf{x}} = \mathbf{f}(\mathbf{x}) \\ \mathbf{y} = \mathbf{g}(\mathbf{x}) \\ \mathbf{y}(t) \in [\mathbf{y}](t) \end{cases}$$

Codac yields an envelope for $\mathbf{x}(t)$.



The screenshot shows a web browser with the URL codac.io. The left sidebar contains a navigation menu with the following items: "Codac main page", "Try Codac online with Python", "Installing the Codac library", "Start a Python project", "Start a C++ project", "USER MANUAL", "Introduction", "Basic structures for real values", "Domains: sets of feasible values", "Inclusion functions", "Static contractors", "Temporal contractors", "Contractor Networks", and "Set-Inversion and separators". The main content area is titled "Codac: constraint-programming for robotics" and includes a "View page source" link. The text describes Codac as a C++/Python library for constraint programming over reals, trajectories, and sets, with applications in state estimation and robot localization. It also includes a section titled "What is constraint programming?" which explains the paradigm of concentrating on the properties of a solution rather than how to solve it.

Codac main page

Try Codac online with Python

Installing the Codac library

Start a Python project

Start a C++ project

USER MANUAL

Introduction

Basic structures for real values

Domains: sets of feasible values

Inclusion functions

Static contractors

Temporal contractors

Contractor Networks

Set-Inversion and separators

Codac: constraint-programming for robotics

[View page source](#)

Codac: constraint-programming for robotics

Codac (Catalog Of Domains And Contractors) is a C++/Python library providing tools for **constraint programming** over reals, trajectories and sets. It has many applications in **state estimation** or **robot localization**.

What is constraint programming?

In this paradigm, users concentrate on the properties of a solution to be found (e.g. the pose of a robot, the location of a landmark) by stating **constraints on the variables**. Then, a solver performs *constraint propagation* on the variables and provides a reliable set of **feasible solutions** corresponding to the problem. In this approach, the user concentrates on **what** is the problem instead of **how** to solve it, thus leaving the computer dealing with the *how*.

An interval based library for verification in robotics

3. Publications de 2022

- ① A. Morge, V. Pelle, J. Wan and L. Jaulin (2022). Experimental Studies of Autonomous Sailing with a Radio Controlled Sailboat, IEEE Access.
- ② C. Viel, J. Drupt, C. Dune, V. Hugel (2022). ROV localization based on umbilical angle measurement, Ocean engineering.
- ③ L. Jaulin (2022). Actions of the hyperoctahedral group to compute minimal contractors, Artificial Intelligence, Volume 313.
- ④ J. Damers, L. Jaulin and S. Rohou (2022). Lie symmetries applied to interval integration, Automatica, Volume 144.
- ⑤ C. Viel (2022). Self-Management of ROV Umbilical Using Sliding Buoys and Stop, IEEE Robotics and Automation Letters. Volume 7, Issue: 3, page(s): 8061-8068.
- ⑥ A. Ehambram, L. Jaulin and B. Wagner (2022). Hybrid Interval-Probabilistic Localization in Building Maps, IEEE Robotics and Automation Letters. Volume 7, Issue: 3, page(s): 7059-7066

- 7 A. Rauh, Y. Gourret, K. Lagattu, B. Hummes, L. Jaulin, J. Reuter, S. Wirtensohn and P. Hoher (2022). Experimental Validation of Ellipsoidal Techniques for State Estimation in Marine Applications, Algorithms.
- 8 I. Mopin, J. Marchal, M. Legris, G. Le Chenadec, P. Blondel, B. Zerr (2022). Design and field testing of a non-linear single-beam echosounder for multi-frequency seabed characterization, Applied Acoustics, Elsevier.
- 9 L. Jaulin (2022). Géométrie et Commande des Drones, Techniques de l'ingénieur.
- 10 A. Bourgois, S. Rohou, L. Jaulin and A. Rauh (2022). Proving Feasibility of a Docking Mission: A Contractor Programming Approach, Mathematics.
- 11 C. Viel (2022). A Self-management of the umbilical of a ROV for underwater exploration, Ocean Engineering.
- 12 J. Tillet, L. Jaulin, F. Le Bars and R. Boukezzoula (2022). A

Fuzzy Set Estimation Using Interval Contractors: Application to Localization, Reliable Computing, pp. 4-25.

- 13 R. Boukezzoula, L. Jaulin and D. Coquin (2022). A New Methodology for Solving Fuzzy Systems of Equations: Thick Fuzzy Sets Based Approach, Fuzzy Sets and Systems, 435, pp 107-128.