FLANDERS MAKE

DRIVING INNOVATION IN MANUFACTURING

2022-2026 SBO REXPEK

ROBOTIC VIRTUAL USE-CASE

TUTORIAL

UGent-D2LAB/FM-MIRO ©

ROBOTIC VIRTUAL USE-CASE

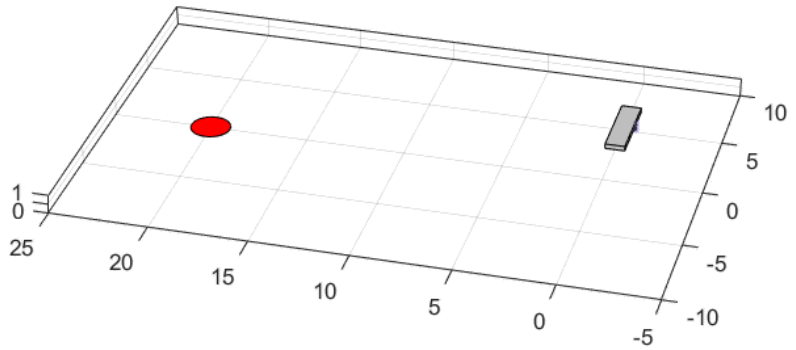
concept

- large scale human tuning experiment
- expected outcome
    - data set with human tuning experiments
    - insights into human approach
        - task specific
        - task aspecific
- tool
    - MATLAB GUI
    - emulating a tuning cycle of a robotic use-case
    - automated data acquisition and delivery

ROBOTIC VIRTUAL USE-CASE

use-case

- set-up
  - sequential pushing of an object to a goal
  - variable goal
    - position, x_g and y_g
  - variable dynamics
  - variable control strategies



- modelling
  - quasi-static assumption (friction forces >> inertial forces)
  - differential kinematic model
    - modelling details can be found in 'lefebvre2023JDMC.pdf', *"Differential Flatness of Slider-Pusher Systems for Constrained Time Optimal Collision Free Path Planning"*
    - system state
      - position, x and y
      - orientation, θ

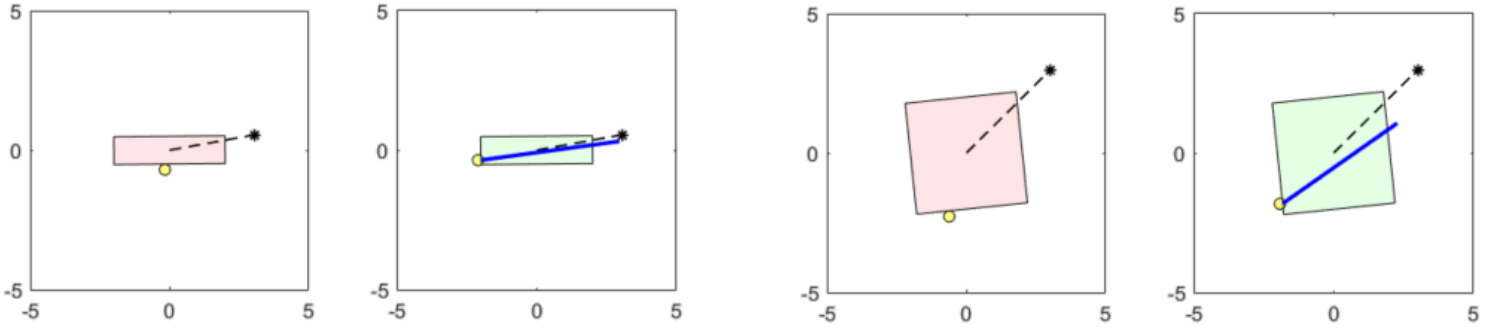
use-case

- control strategy
  - sequence of open-loop pushes parameterised by
    - duration of push, $\Delta T = N \cdot \delta t$
    - amplitude of push, A

$$\|u(t)\| = A \cdot \sqrt{(x(0) - x_g)^2 + (y(0) - y_g)^2}, \quad A > 0$$

    - angle of push, α

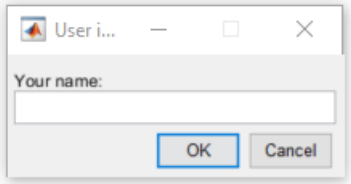
$$\theta_c = (1 - \alpha) \cdot \theta_g + \alpha \cdot \theta, \quad \alpha \in (0, 1]$$



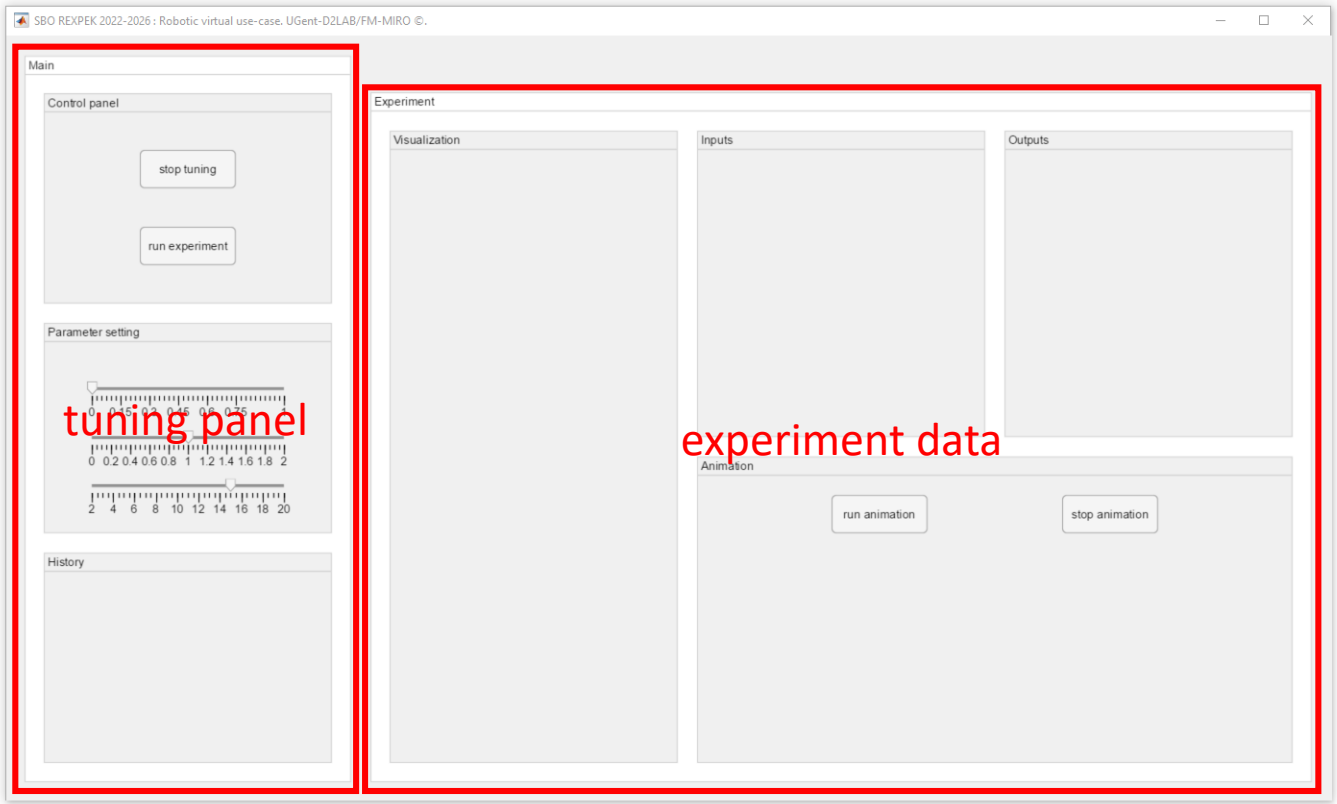
ROBOTIC VIRTUAL USE-CASE

GUI

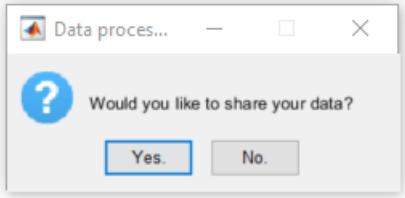
- log-in screen



- main control panel



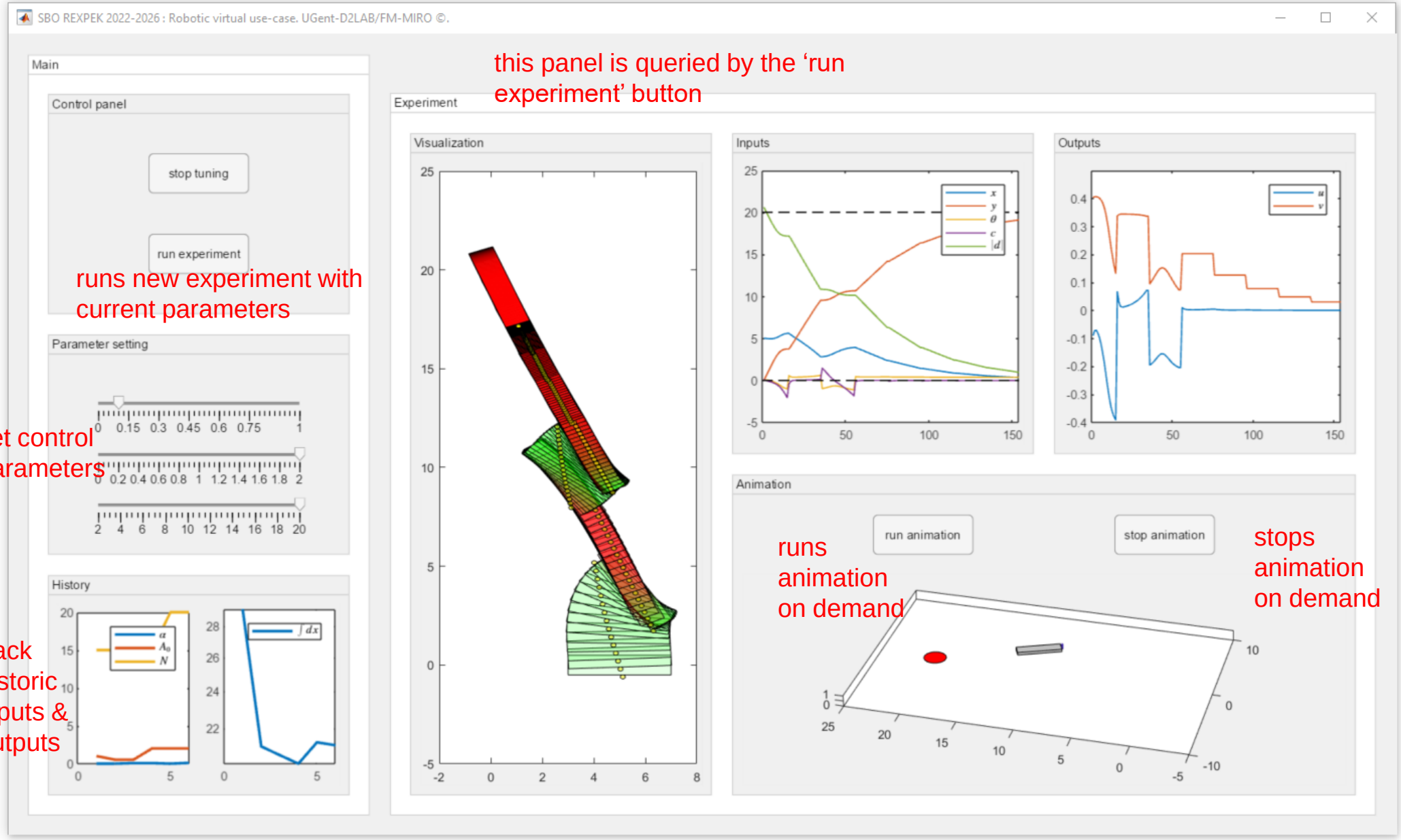
- log-out screen



ROBOTIC VIRTUAL USE-CASE

GUI

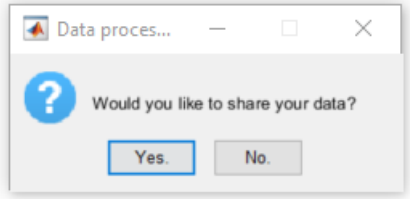
- main



ROBOTIC VIRTUAL USE-CASE

GUI

- log-out screen



  - data is processed and send to ‘tom.lefebvre@ugent.be’ (will be changes in the future)

  - in CSV format

	A	B	C	D	E	F
1	i	a	A	N	T	D
2	1	0	1	15	29.1614	
3	2	0	0.52	15	21.0839	
4	3	0.075	0.52	15	20.6521	
5	4	0.075	2	15	20.2433	
6	5	0	2	20	21.2878	
7	6	0.1	2	20	21.1393	
8						
9						

future work

- improve difficulty of tuning
- include variability & possibly changing context
- change data acquisition format