Escola Tècnica Superior d'Enginyeria

Universitat Rovira i Virgili

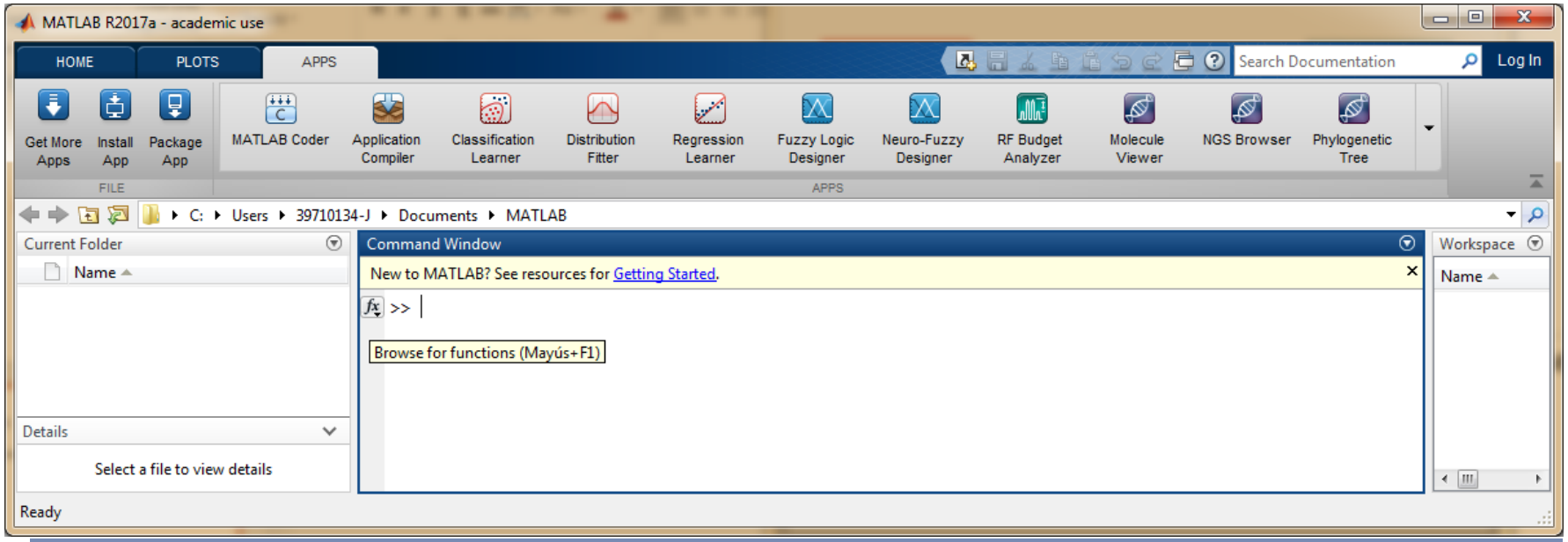
[DEIM]

LAB: Linguistic Variables with Fuzzy Sets

Matlab Fuzzy Toolkit

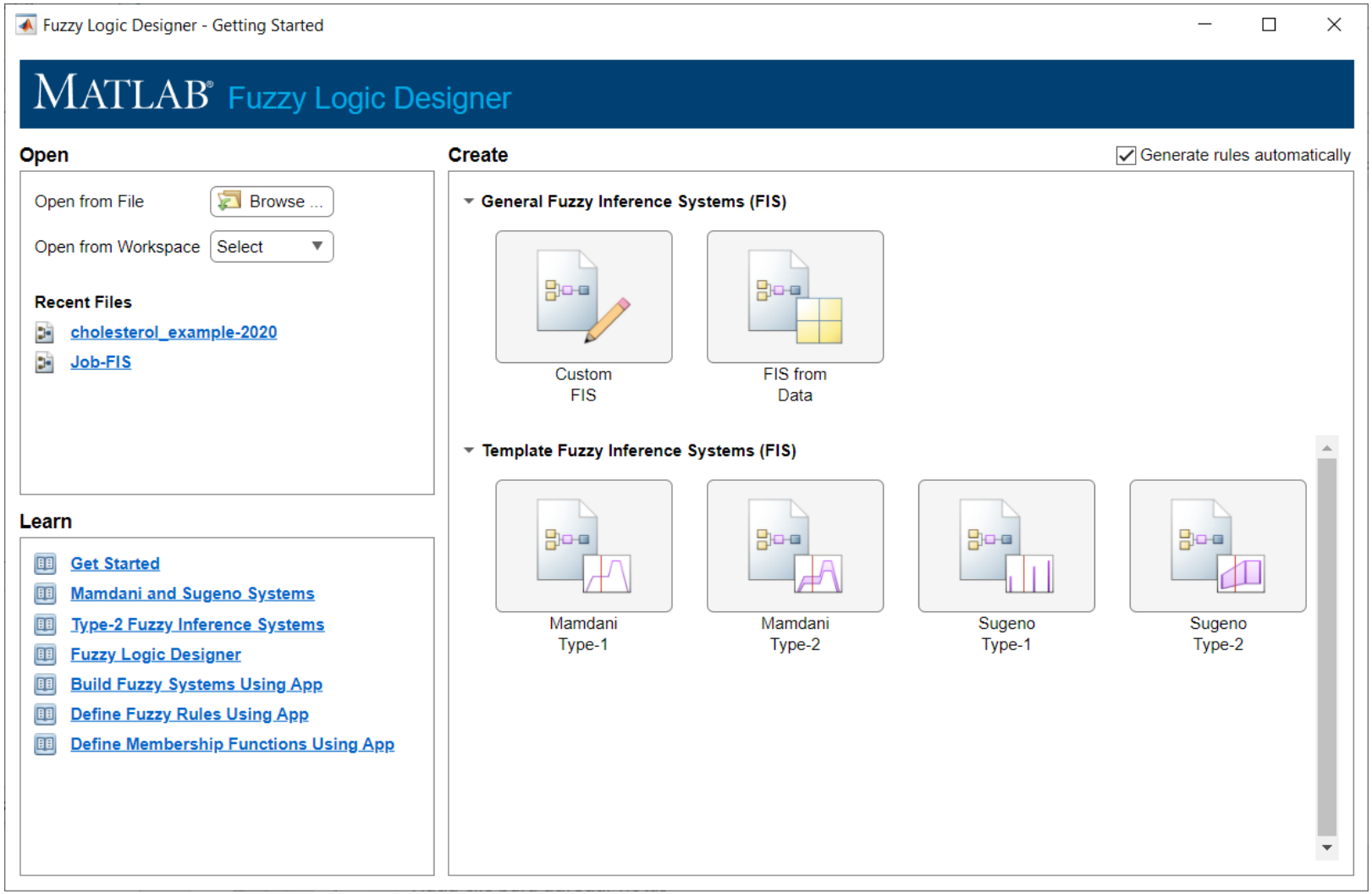
Software Matlab

- We will use Matlab. You can find it in VirtLabs section in the URV intranet. Install a version before R2022b.
- Then open Matlab and go to Apps => Fuzzy Logic Designer



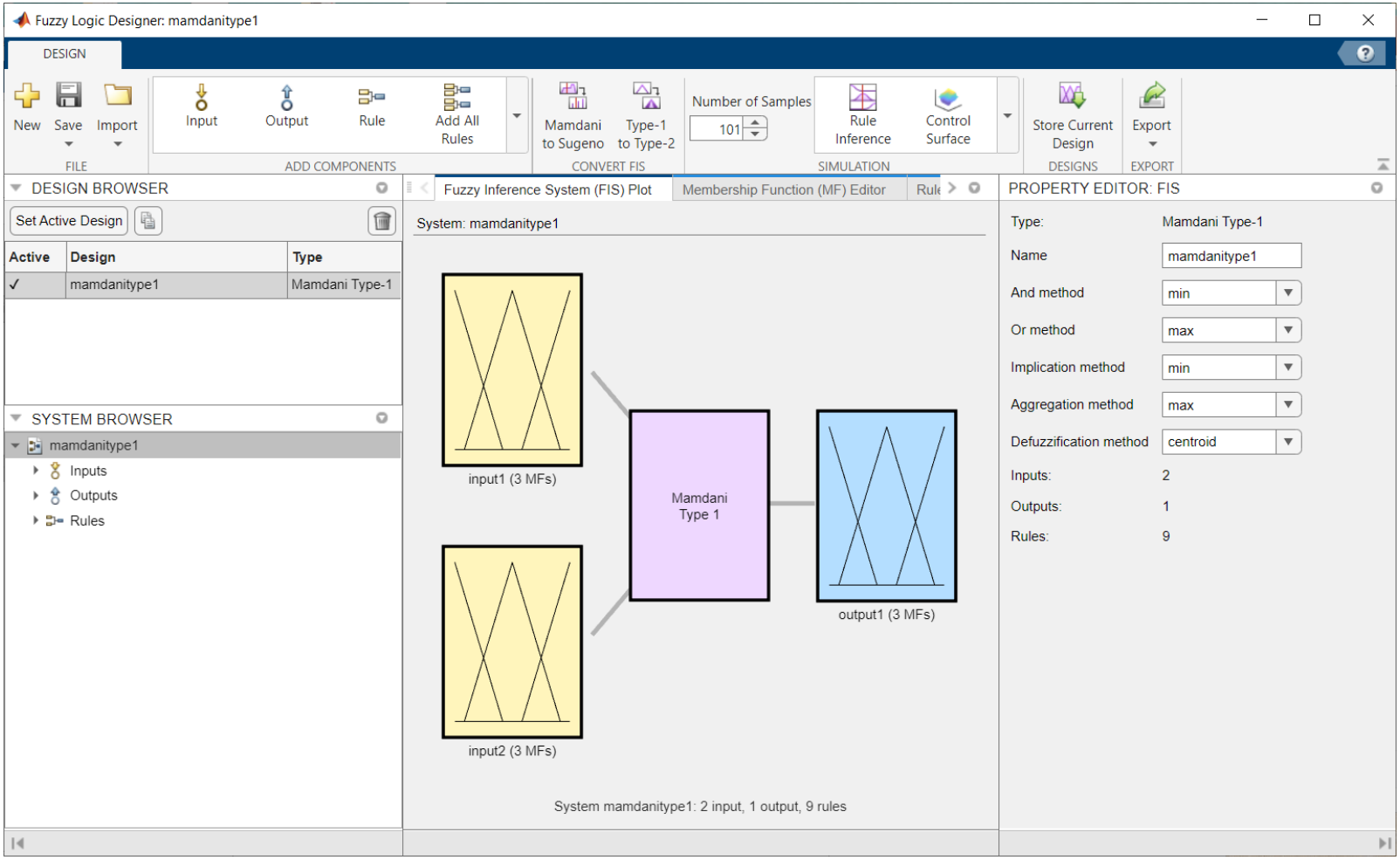
Software: Matlab version R2022b

- Create a FIS (fuzzy inference system) from CUSTOM FIS.
- Or from Mamdani Type1.



version R2022b

Main window: empty project



In the main window of FIS, you can configure the operators (explained in other slides). We concentrate now on the input/output variables.

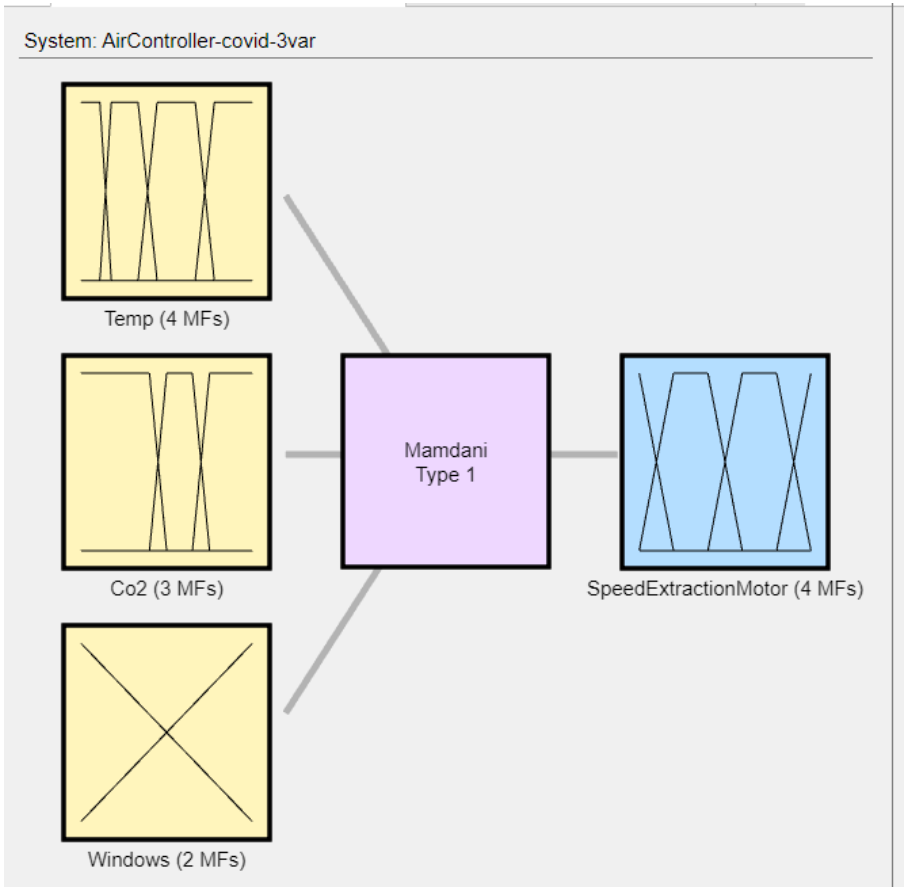
Example: C02 air controller

We have a fuzzy expert system to control the CO2 in a classroom.

We have 3 input linguistic variables:

- Temperature at classroom (ºC)
- Co2 measured in
- Windows state (open / closed)

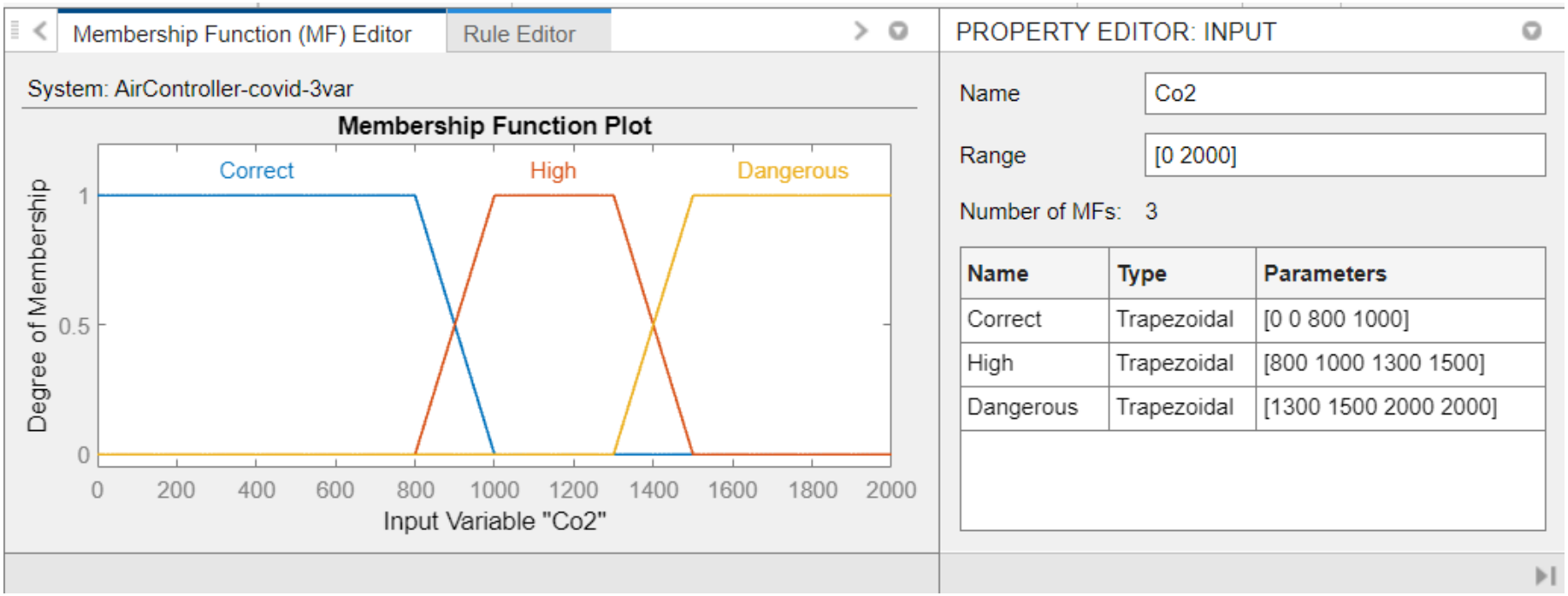
With these 3 inputs, the system calculates the speed of the extraction motor available in the classroom.



Example: C02 air controller

Definitions of the variables are as follows. Example:

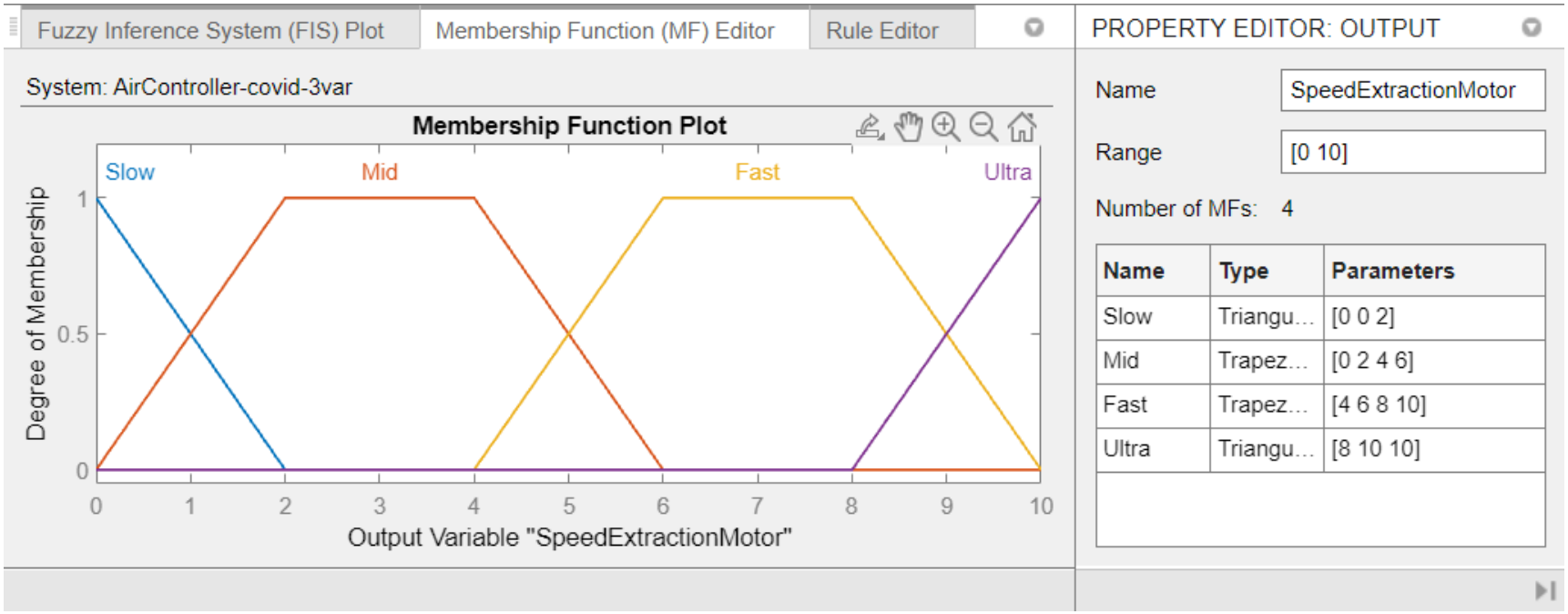
- Variable Co2 ranges from 0 to 2000, and it has 3 labels (MFs) with different covering of this range. Trapezoidal fuzzy sets are used.



Example: C02 air controller

The output variable is also a linguistic variable, with a range of velocity between 0 (stop) and 10 (maximum speed).

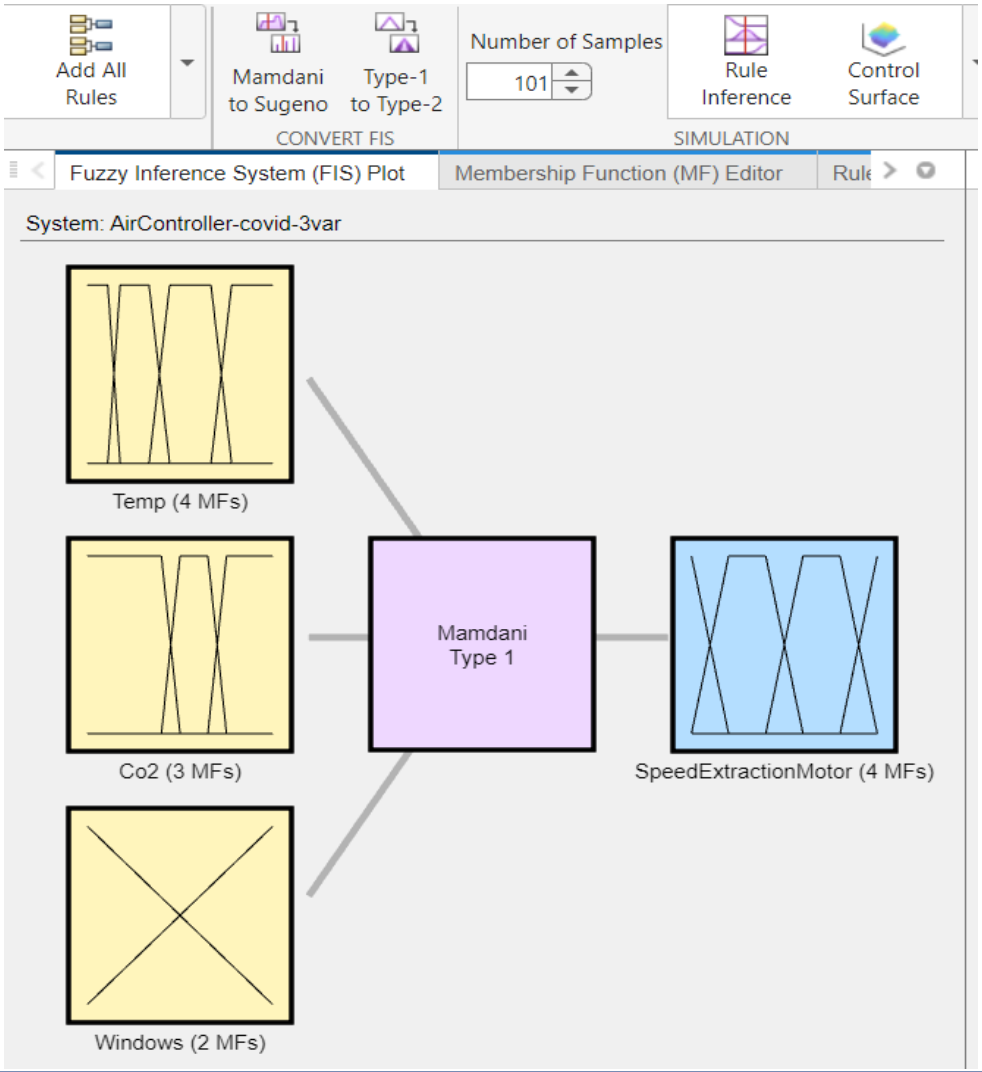
Four linguistic terms are used. Two triangular and two trapezoidal.



FIS variables definition

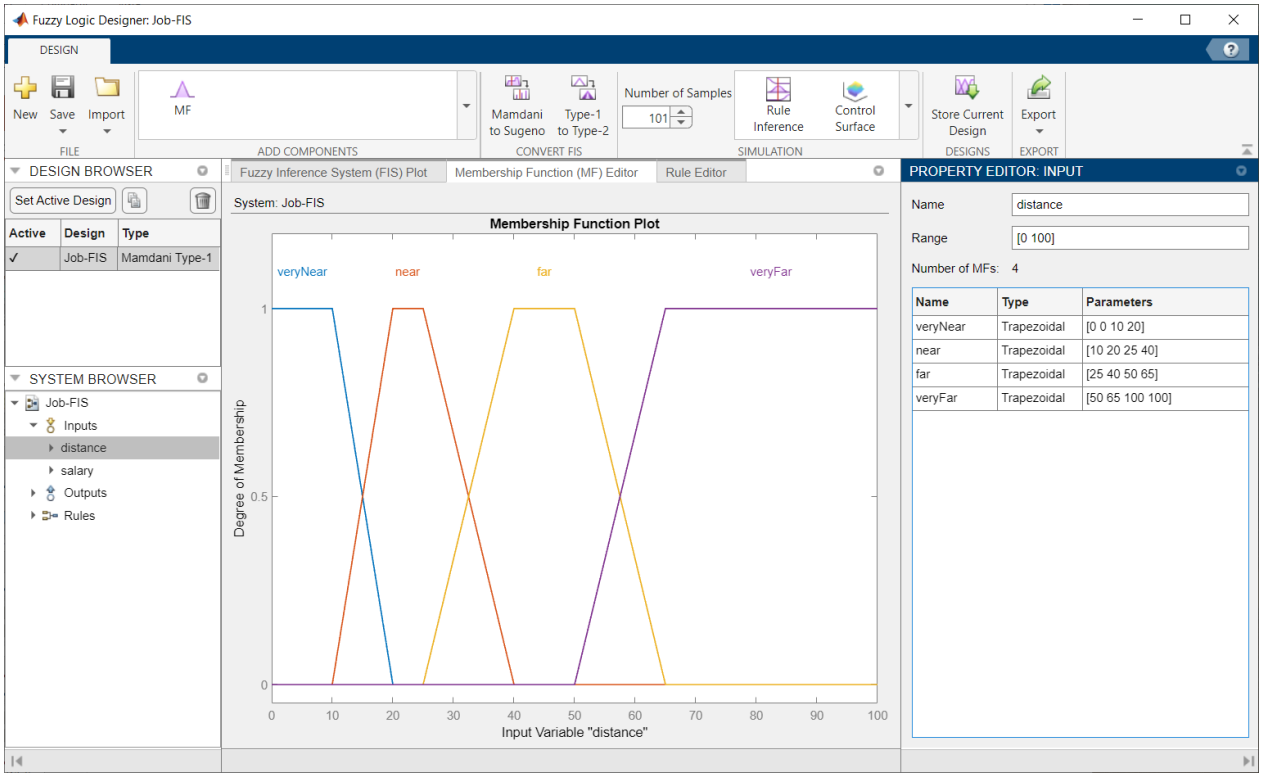
version R2022b

- The central panel shows:
  - Inputs: in yellow
  - Outputs: in blue
- Select tab “Membership Function MF Editor”
- Add more variables in the left window



FIS variables definition

version R2022b



- For each variable you can configure the name & range.
- You can configure the names and fuzzy sets of each label. Params indicate the x points that define the fuzzy set.
- In the top left menu bar, we can add more labels (mfs)

General issues

- You can create new projects from menu options. Choose Mamdani (type I)
- You can also import projects you already have.
- Export your project to a file before leaving the software, in File menu option.

Exercise1: Job recommender variables

We want to construct an expert system for evaluating jobs offers.

- Generate two input variables called “distance” and “salary” with the following linguistic values:
  - **Distance** (0 to 100 km): “very near”(about 10km), “near” (about 20km), “far”(about 50km), “very far”(about 80km)
  - **Salary** (700 to 4000 €): “minimum”(smaller than 1000€), “normal” (about 1800€), “good”(about 2500€), “awesome” (about 3500€)

- Construct an output variable to measure our “interest” in a job. The output will be given in a scale from 0 to 10.
  - Decide the number of labels, names and fuzzy sets.

1. Use different types of membership functions: triangular, trapezoidal, Gaussian or sigmoidal
2. Use symmetric and asymmetric/unbalanced fuzzy sets