Fuzzy Controller Class

This class implements a fuzzy controller containing the rules and membership functions depicted in fuzzy_settings.pdf. If you don't know how a fuzzy controller works, check Fuzzy.pdf for more information. To summarize, it works by replacing a PID to control a system, receiving the error as the input and outputting the control signal. For this controller, it receives a ratio to quantify the position of the robot and its angle, and outputs the left and right wheel velocity in percentage. To understand how the ratio is calculated, let b_R and b_L be the right and left model's intercept, respectively. Let $b_{max}=max(|b_R|,|b_L|)$ and $b_{min}=min(|b_R|,|b_L|)$, this way we can calculate the ratio by doing $r=\frac{b_{min}}{b_{max}}-1$ and multiply by -1 if $|b_R|<|b_L|$. This class utilizes the open library fuzzylite, for more information go to https://fuzzylite.com/.

Public Methods

- FuzzyController ( )

  FuzzyController::FuzzyController
  (
  fl::Tnorm* AndMethod = new fl::Minimum,
  fl::Snorm* OrMethod = new fl::Maximum,
  fl::Tnorm* ImplicationMethod = new fl::AlgebraicProduct,
  fl::Snorm* AggregationMethod = new fl::Maximum,
  fl::Defuzzifier* defuzzMethod = new fl::Centroid(100)
)

  Default constructor that assigns default operators to the fuzzy controller, adding the possibility of changing

  Parameters

  AndMethod is the and / conjunction operator
  OrMethod is the or / disjunction operator
  ImplicationMethod is the implication operator
  AggregationMethod is the aggregation operator
  defuzzMethod is the defuzzification operator

- getOutputValues ( )

  FuzzyController::getOutputValues (const double ratio,
  const double ang
)

  Receives the input data, calculates and returns the controller's output

  Parameters

  ratio is the ratio explained previously
  ang is robot's angle

- friend operator << ( )

  std::ostream & operator << (std::ostream & out, const FuzzyController & fz)

  Print fuzzy controller object

  Parameters

  out is where to print, normally terminal

  fz is the object to be printed