## Algoritmo Genético

SIAI - 2019/2

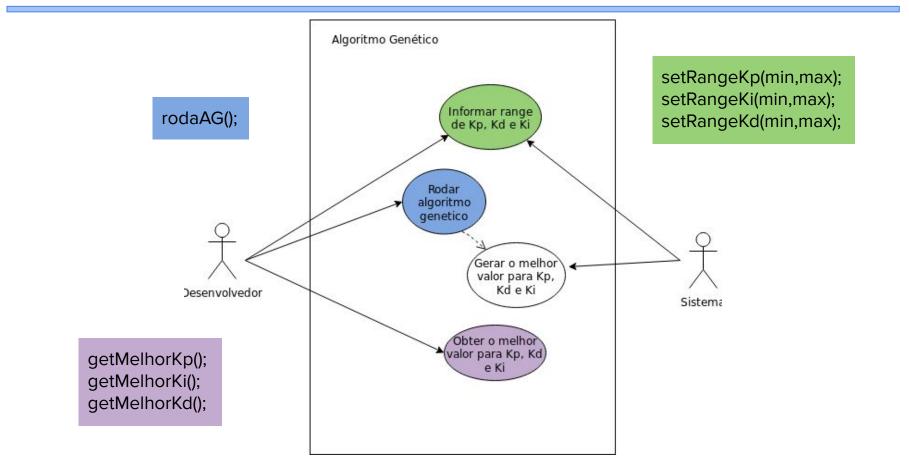
Seminário 2

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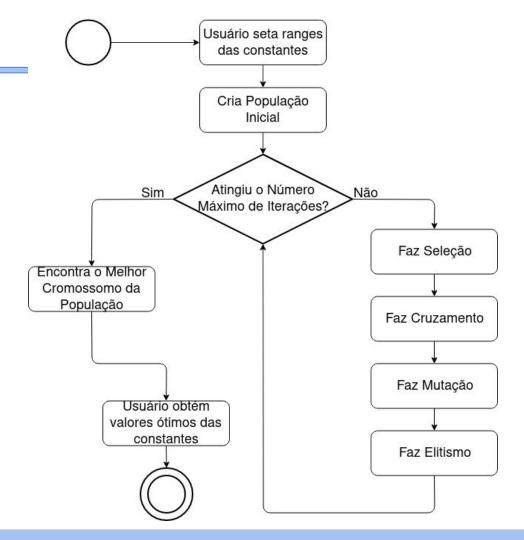
### AG - Proposta

- Desenvolvedor controla o AG
- Atuação:
  - Antes de entregar o robô
  - Correções periódicas
- Otimização

#### AG - Diagrama de Casos de Uso



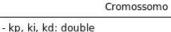
#### AG - Diagrama de Atividades



#### AG - Diagrama de Classes

#### AlgoritmoGenetico

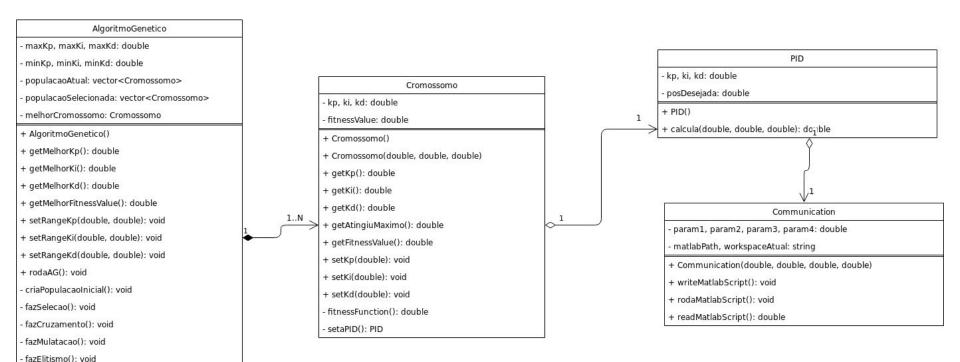
- maxKp, maxKi, maxKd: double
- minKp, minKi, minKd: double
- populacaoAtual: vector<Cromossomo>
- populacaoSelecionada: vector<Cromossomo>
- melhorCromossomo: Cromossomo
- + AlgoritmoGenetico()
- + getMelhorKp(): double
- + getMelhorKi(): double
- + getMelhorKd(): double
- + getMelhorFitnessValue(): double
- + setRangeKp(double, double): void
- + setRangeKi(double, double): void
- + setRangeKd(double, double): void
- + rodaAG(): void
- criaPopulacaoInicial(): void
- fazSelecao(): void
- fazCruzamento(): void
- fazMulatacao(): void
- fazElitismo(): void



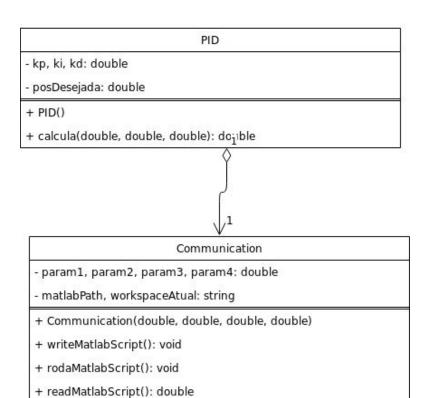
- fitnessValue: double
- + Cromossomo()
- + Cromossomo(double, double, double)
- + getKp(): double
- + getKi(): double
- + getKd(): double
- + getAtingiuMaximo(): double
- + getFitnessValue(): double
- + setKp(double): void
- + setKi(double): void
- + setKd(double): void
- fitnessFunction(): double
- setaPID(): PID

1..N

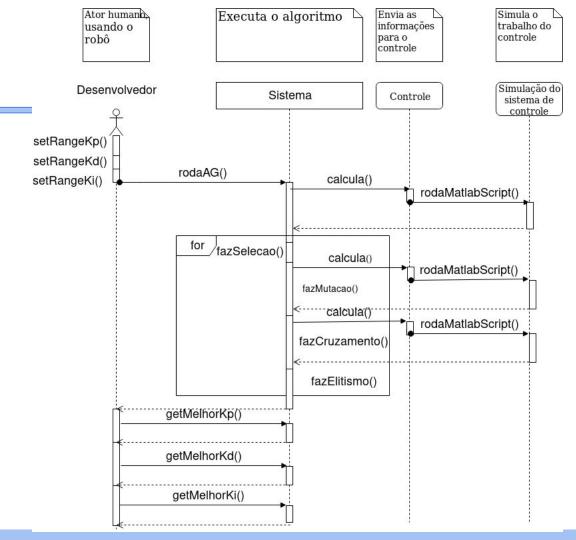
#### AG - Diagrama de Classes



#### AG - Diagrama de Classes

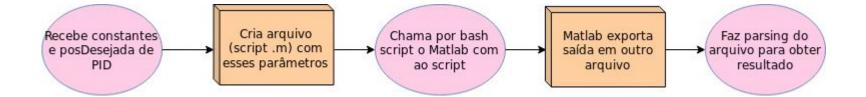


## AG - Diagrama de Sequências

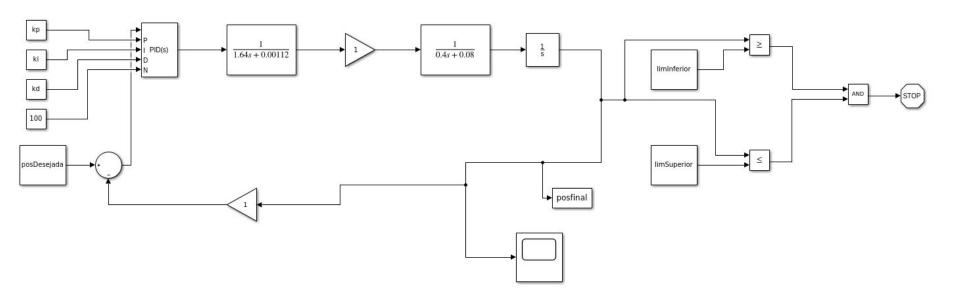


#### AG - Comunicação Interna

Classe Communication



### AG - Simulação



#### AG - Simulação

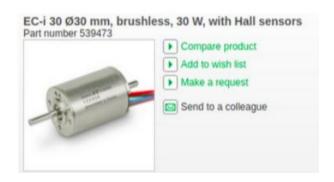
L = 0.00112

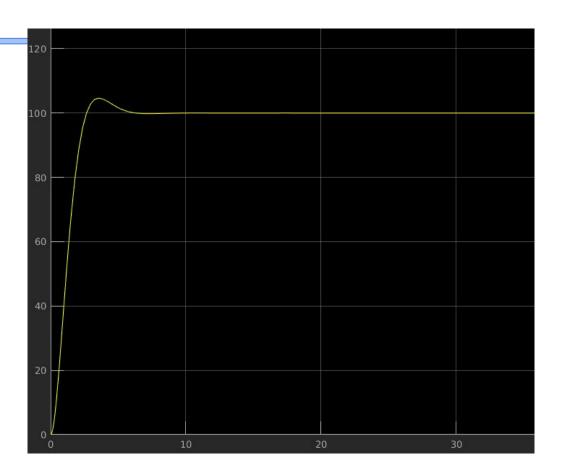
R = 1.64

B = 0.4

J = 0.08

— Retirados de um motor da Maxon e de experimentos da disciplina de Controle





#### AG - Testes

```
KP = [1.5; 10]

KI = [1; 2.5]

KD = [1; 1.5]
```

POS\_DESEJADA = 25 TAM\_POPULAÇÃO = 8 TAM\_SELEÇÃO = 6 TAM\_TORNEIO = 4 NUM\_ITERAÇÕES = 10

> Kp = 9.34104 Ki = 2.03431 Kd = 1.33909 Fitness Value = 0.139

```
Cromossomo Inicial 0
kp = 4.67986 ki = 1.8641 kd = 1.203
Kp = 4.67986 | Ki = 1.8641 | Kd = 1.203 | Fitness Value = 0.3353
Cromossomo Inicial 1
kp = 1.73344 ki = 1.91413 kd = 1.09956
Kp = 1.73344 | Ki = 1.91413 | Kd = 1.09956 | Fitness Value = 0.7987
Cromossomo Inicial 2
kp = 3.68999 ki = 1.79173 kd = 1.10455
Kp = 3.68999 | Ki = 1.79173 | Kd = 1.10455 | Fitness Value = 0.4473
Cromossomo Inicial 3
kp = 8.36439 ki = 1.643 kd = 1.18671
Kp = 8.36439 | Ki = 1.643 | Kd = 1.18671 | Fitness Value = 0.1786
Cromossomo Inicial 4
kp = 7.68632 ki = 2.21771 kd = 1.42343
Kp = 7.68632 | Ki = 2.21771 | Kd = 1.42343 | Fitness Value = 0.1641
Cromossomo Inicial 5
k_D = 6.18187 \text{ ki} = 2.35391 \text{ kd} = 1.09913
Kp = 6.18187 | Ki = 2.35391 | Kd = 1.09913 | Fitness Value = 0.259
Cromossomo Inicial 6
kp = 9.34104 ki = 2.03431 kd = 1.14177
Kp = 9.34104 | Ki = 2.03431 | Kd = 1.14177 | Fitness Value = 0.1621
Cromossomo Inicial 7
kp = 5.20123 ki = 1.70723 kd = 1.33909
Kp = 5.20123 | Ki = 1.70723 | Kd = 1.33909 | Fitness Value = 0.2792
Iteracao 0
Iteracao 1
Iteracao 2
Iteracao 3
Iteracao 4
Iteracao 5
Iteracao 6
Iteracao 7
Iteracao 8
Iteracao 9
Kp = 9.34104
Ki = 2.03431
Kd = 1.33909
Fitness Value = 0.139
```

#### AG - Desenvolvido

- Código principal em C++
- Chama a simulação por bash script
- Comunicação interna por arquivos (matlab script e matlab output)
- Chama simulação do Simulink (PID + Motor)
- Testes.
- Github: https://bit.ly/2kTEvVZ

# Dúvidas?