

Tugas II sistem pengaturan Formasi dan kolaborasi

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1. The title: A survey of consensus problems in multi-agent coordination.

Author: Wei Ren, Randal W. Beard Ella M. Atkins

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Review: Theoretical aspects of consensus problem there are recent theoretical of consensus problems. Convergence analysis for a time invariant information exchange topology, it is assumed that if one agent can access another agent’s information at one time, it can obtain information from that agent all the time. Equilibrium state under a time invariant topology. Convergence analysis for dynamic information exchange topologies, the information exchange topology between agents may change dynamically in reality. For instance, communication links between agents may be unreliable due to disturbances and/or subject to communication range limitations. Relative information uncertainty, in practical applications of multi-agent systems, there are many cases where some individuals on the team will have access to better information than others. In cases like these the consensus algorithm needs to be biased to favor agents with better information. Communication delays, In the case that information is exchanged between agents through communications, time delays of the communication channels need to be considered. Consensus synthesis, a state feedback controller that guarantees consensus for the closed loop system without disturbance as well as a state feedback controller that achieves not only consensus but optimal performance for disturbance attenuation. Necessary and sufficient convex conditions are derived for the existence of such state feedback controllers. The study of consensus problems for a team of agents with more complicated nonlinear dynamics and a team of heterogenous agents is an interesting topic for future research. Most research in consensus problems assumes that the final consensus value to be reached is inherently constant, which may not be the case in the sense that the information state of each agent may be dynamically evolving in time according to some inherent dynamics, as happens in some formation control problems where the formation is moving through space. It will be interesting to study consensus problems where the final consensus value evolves with time or as a function of vehicle/environmental dynamics. Furthermore, consensus problems may be studied from a stochastic point of view to take into account the case that at each time instance the existence of an information exchange link between agents may be probabilistic. In the current literature, most research activities focus on theoretical study of consensus problems and most results are demonstrated via simulations except for a few experimental results of multiple mobile robot coordination with strongly connected time-invariant sensing/communication topologies. Experimental implementation of consensus schemes for multiple agent systems is a key element of research in the future. Furthermore, issues like disturbances, time delay, communication/sensor noise, and model uncertainties should also be taken into account.

1. Simulate the continuous consensus protocol for a graph on five vertices. Write your code and compare the rate convergence of the states as the number of edge increases. Does the convergence of the protocol always improve when the graph contains more edges? Provide an analysis to support your observation.

Code:

clc; clf; clear all

% Define Laplacian matrix

L = [2 -1 0 0 -1;

-1 2 -1 0 0;

0 -1 2 -1 0;

0 0 -1 2 -1;

-1 0 0 -1 2];

% Define initial state

x0 = [1; 2; 3; 4; 5];

% Define time range and step size

tspan = [0 10];

dt = 0.01;

% Define ODE function

odefun = @(t, x) -L\*x;

% Solve ODE

[t, x] = ode45(odefun, tspan, x0);

% Plot results

plot(t, x);

legend('Vertex 1', 'Vertex 2', 'Vertex 3', 'Vertex 4', 'Vertex 5');

xlabel('Time');

ylabel('State');

the result of this program is.



1. a).

Diagram

Description automatically generated

Hence there are three strongly connected components

A picture containing diagram

Description automatically generated

b). yes, they finally converge on a common decision, that is on and the initial opinion of converge of , get rejected.

c). for , has a result the final position , from figure below show that the final position in 4.2



1. -
2. -