

Break-away Phenomenon and Its Algorithm, Applications

Wang Xing-bo

College of Information Science and Technology,
Hunan Agricultural University, 410128,PRC,
dr.xbwang@gmail.com

Abstract

Break away phenomenon is abstracted from that cars at the crossroad are finding their ways out. As is seen, at the moment the light turns red, each vehicle will slow down and find a proper position to station itself and each one will keep a small distance from the others to avoid collision; at the moment the light turns green, each vehicle starts out from its stationary position at a speed different from the others; and each one will find a safest and fastest path to break away.

This is the break-away phenomenon. With more vehicles going to break away and some more are coming into the crossroad, it exhibits the following scene:

Difference of the drivers' driving skills and differences of vehicles' function bring difference in the distances from a vehicle to its follower and neighbors. As time goes on, this difference becomes larger; and finally, it makes a room for a vehicle to jump into, or even an empty driveway for someone to pass through, provided that it is permitted to change the driveway. The process repeats until the next red-light on

How to describe this phenomena mathematically and how to use the description in applications lead to break away problem(BAP).

To describe the BAP problem, following assumptions are made:

1. A stationary car has a *station region*, which can be simplified by a rectangular area; a moving car has a speed and a dominating region, called a *domain*; the domain can be calculated by the car's size, turning radius and speed; generally a domain is broader than a station region;
2. A moving car will affect its neighboring area to keep other moving cars away from its domain; the affect will disappear outside of the car's domain;
3. The affect at a spot near two cars is contributed by the two; the nearer a car is close to the spot, the stronger of its affect is; the total affect is no more than each of the two's;

4. A car is permitted to turn left or right, but is forbidden to turn back;
5. A break-away car will seek the nearest way that has no affects of the others to move.

Based on the assumptions, solution of the BAP is proposed by defining *passage* , *station unit*, *affectness function* and *fitness function*. The algorithm to solve the BAP is break away algorithm (BAA) and a Scilab implement for BAA is investigated.

The BAA is quite fit for plant growth process. For example, a organ of a plant will take a space where other organs can not occupy it and when growing, the occupied space continuously changes. Hence the study of BAA is quite valuable.