6.2 About PID

1. What is the PID algorithm?

A: PID is a proportional, integral, differential abbreviation, which represents three control algorithms. Through the combination of these three algorithms, the deviation of the controlled object can be effectively corrected, so that it reaches a stable state.

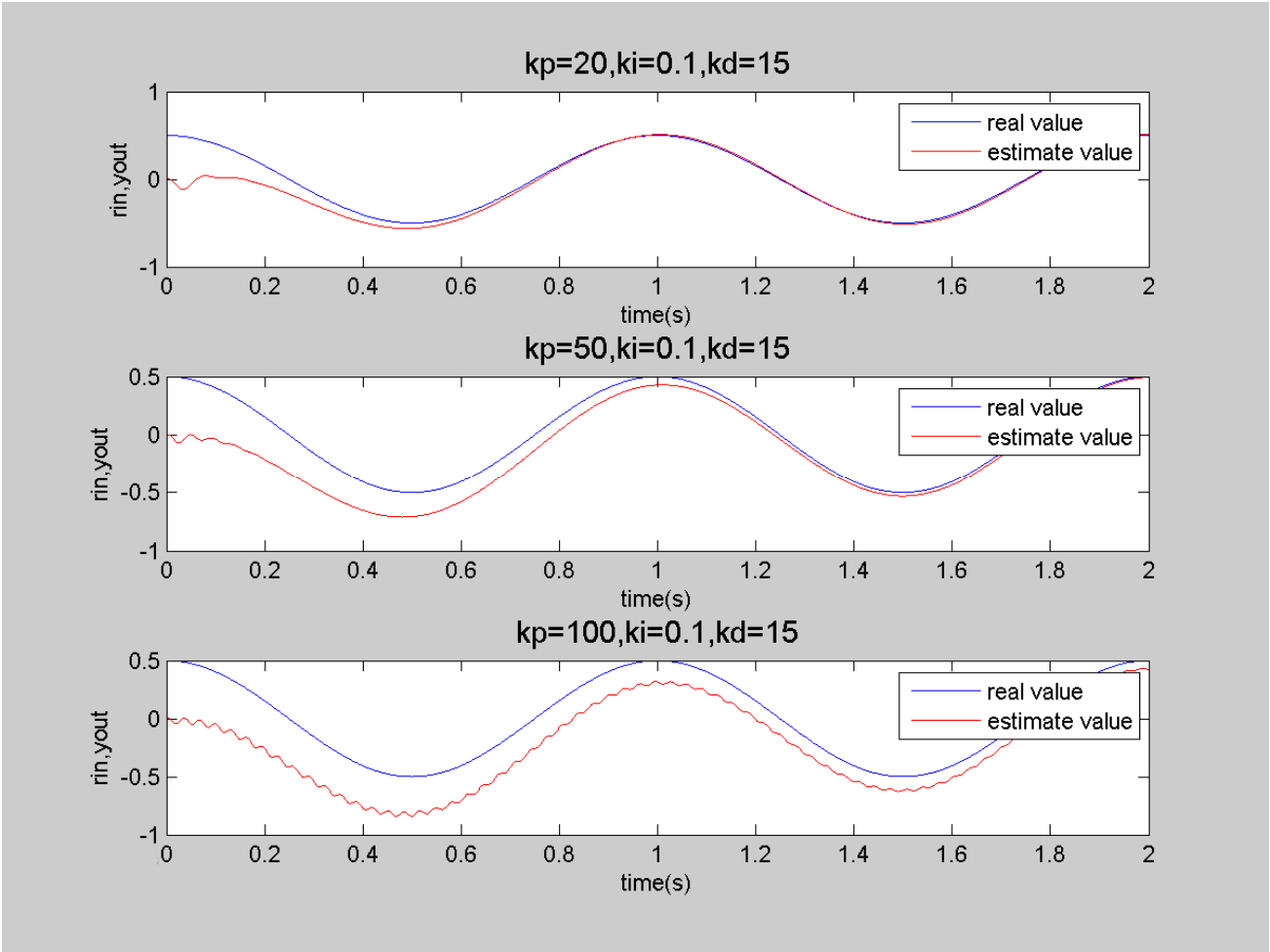
There are many kinds of PID algorithms, and the Omniduino robot car uses an incremental PID algorithm.

PID action (taking control temperature as an example):

1). Proportion (P)

This parameter is the basic (current) deviation e(t) of the reaction system. The coefficient is large, which can speed up the adjustment and reduce the error. If the scale factor is too large, the stability of the system will be degraded, and even the system will be unstable. If the scale factor is too small, the adjustment will be insufficient, the system output will change slowly, and the total time required for adjustment will be too long.

Simple proportional control is difficult to ensure that the adjustment is just right, completely eliminating the error. The curve analysis diagram is as follows:

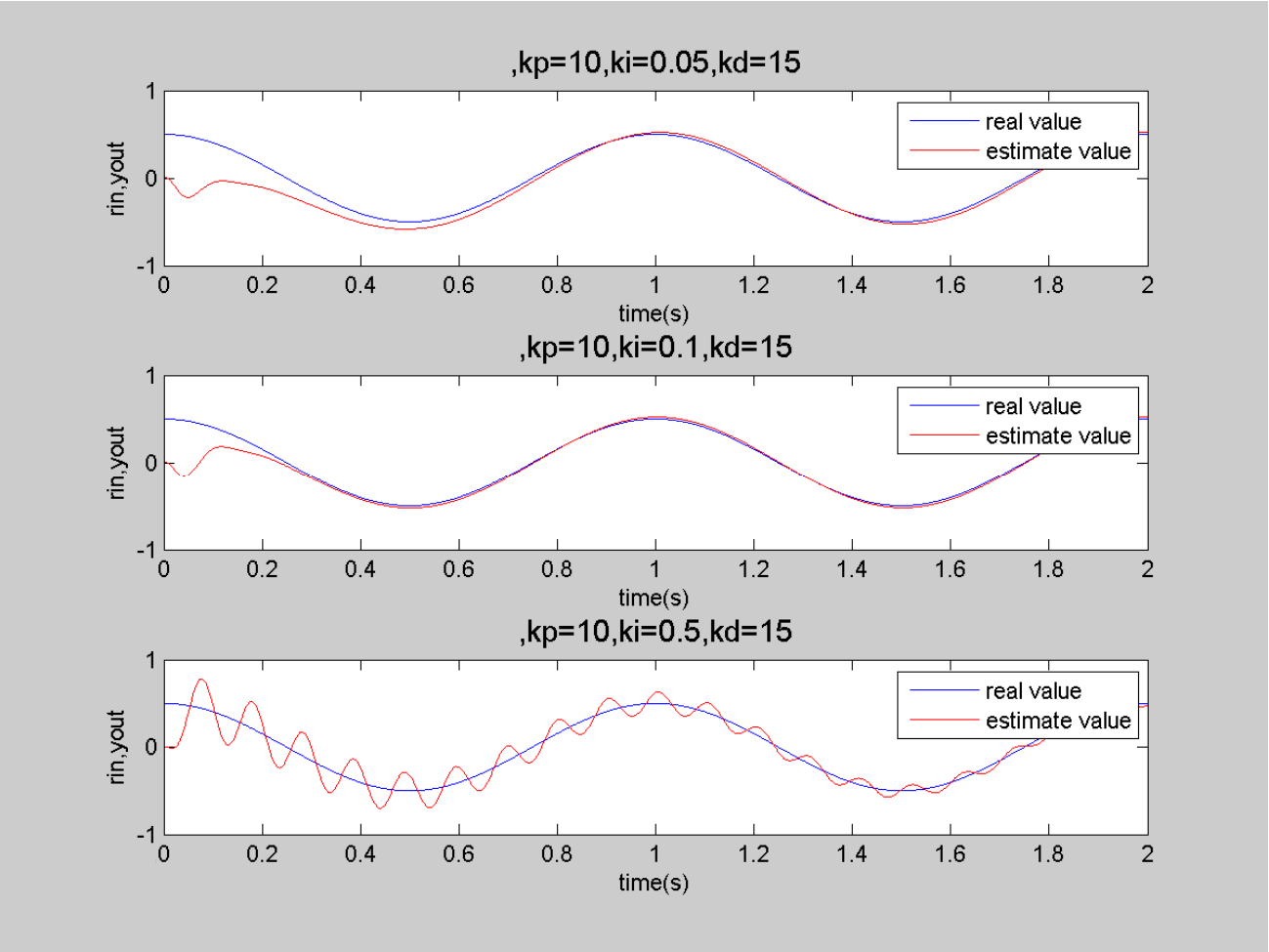


2).Integral (I)

This parameter is used to calculate the cumulative deviation of the reaction system, so that

the system eliminates the steady-state error. If there is an error, the integral adjustment will continue until the error is eliminated. If the integral adjustment direction is correct, the integral term can reduce the error. Until the system is in a stable state, the error is always zero, the proportional part and the differential part are zero, and the integral part does not change any more. Therefore, in order to improve the control precision, the integral action is generally necessary.

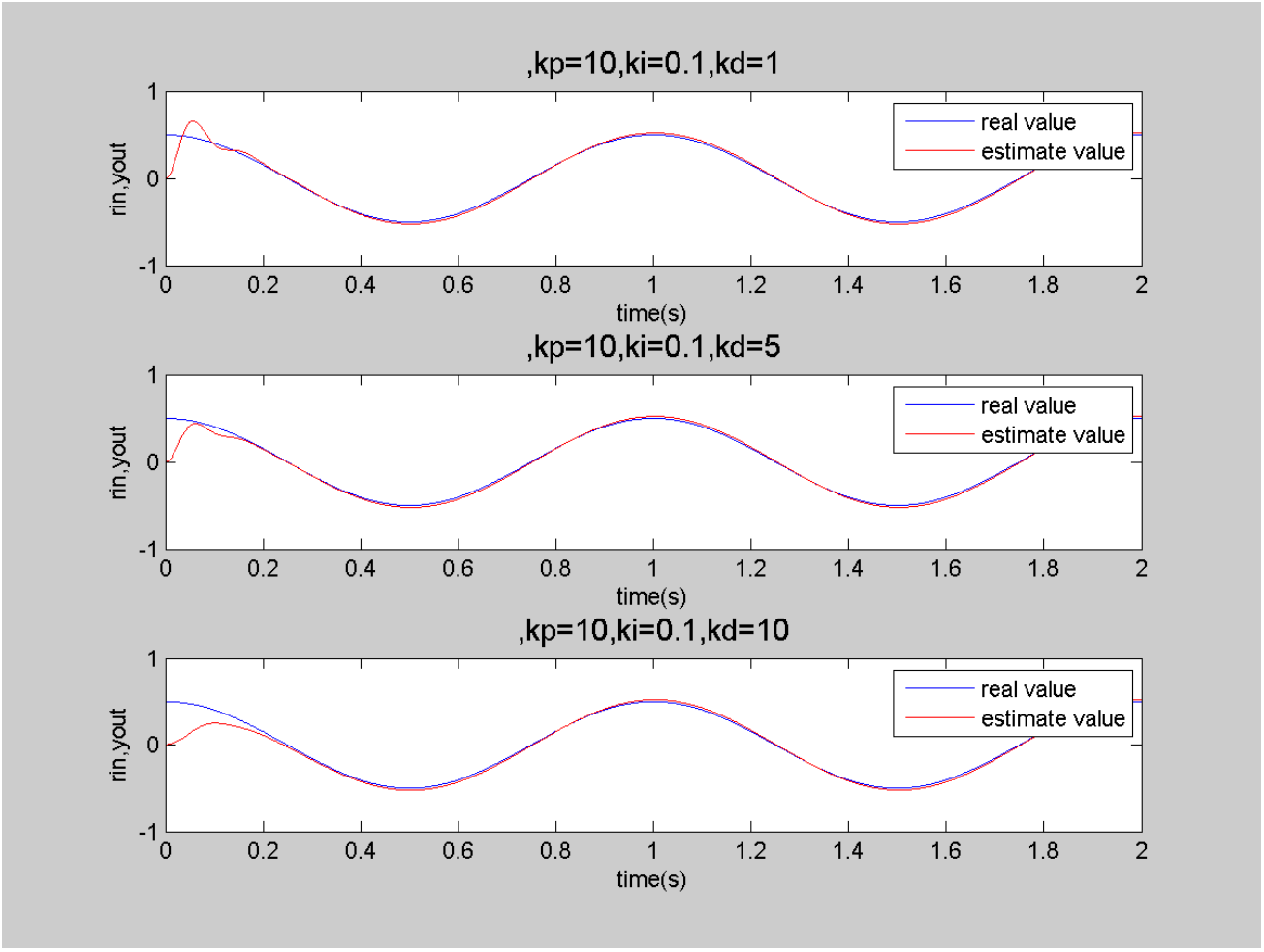
The curve analysis diagram is as follows:



3). Differential (D)

This parameter is used to reflect the rate of change e(t)-e(t-1) of the system deviation signal. It is predictable, can predict the trend of deviation change, and produces advanced control effect. It has been differentiated before the deviation has not formed. The adjustment is eliminated, thus improving the dynamic performance of the system.

The differential of the error is the rate of change of the error. The faster the error changes, the larger the absolute value of the differential. When the error increases, the differential is positive; when the error decreases, the differential is negative. The differential portion of the controller output is proportional to the micro-integration of the error, reflecting the trend of the controlled amount. As shown below:



2. How to use the PID algorithm

How to determine the constant brightness coefficient in the PID algorithm? Generally, it is necessary to debug one by one according to the situation of the own project. This is a cumbersome process. The debugging of PID parameters is a comprehensive process in which various parameters affect each other. It is very important to make many attempts in the actual debugging process. Commonly used control methods: P, PI, PD, PID control algorithm.