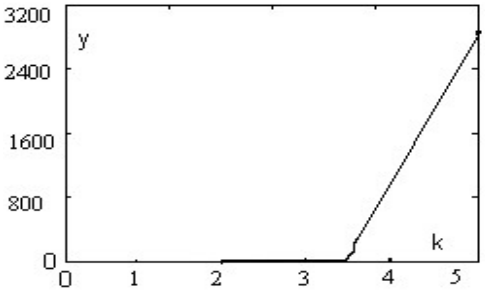

Figure 4: output quantity curve (approximation 2)

It is seen that approximation 2 makes the control fail and the approximation 1 manages to get the control with an effort but has great errors. Its effect is not ideal. Once adding the physics restriction of the control quantity, both approximation ways completely cannot control. The basic reason is that equation (11) has the highest reps. The coefficient of the highest-order power is high, which leads the approximate non-linear relationship of equation (8) and (9) to have big differences from the actual situation, like figure 5:

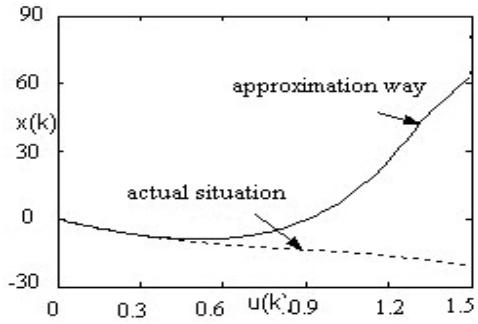

Figure 5: non-linear function comparison

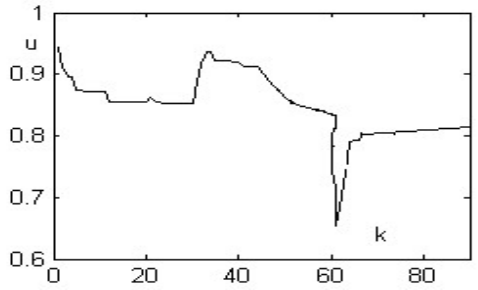

Figure 6: control quantity curve (genetic algorithm)

Now,we take the standard genetic algorithm to count. When we take detailed implementation, we adopt the optimal selection strategy, uniform arithmetic crossover and uniform mutation. The population size is 50; the crossover probability is 0.7; the mutation probability is 0.1 and the largest evolution is 50 generation. Owing to the minimum value problem of the root solving, the fitness function is $Fitness = C - J$. C is a constant. It needs to comprehensively think about the Q and R values which are achieved through attempts for many times. The control quantity curve and output quantity curve gotten by means of genetic algorithm are seen in figure 6 and 7.

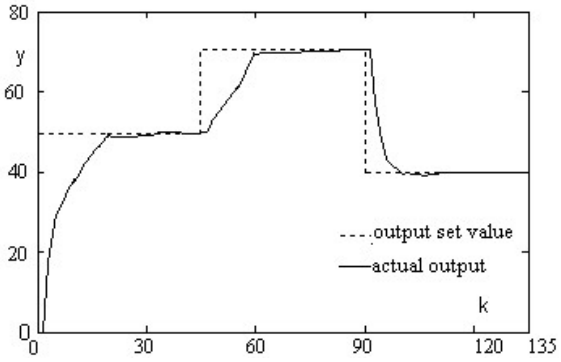

Figure 7: output quantity curve (genetic algorithm)

VII. CONCLUSION

Seen from figure 7,compared with two approximation ways, the predictive controller solving based on the genetic algorithm can enable the system output to better track the reference input and the change of controlled quantity to be more stable. Meanwhile, as a kind of whole solving strategy, genetic algorithm has little dependence on the detailed form of non-linear relationship, without limitation to the low-order polynomial function. Therefore, its fitness range is wider.

It cannot be denied that the rise on this performance is at the cost of counting with more costs. Yet, PH neutralization process and heat exchanger process described with the Hammerstein model usually have quite large time constant. And, the demand on the rapidity is not high. Therefore, the receding-horizon algorithm based on the genetic algorithm is suitable for the online solving control quantity.

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