

Analysis of Complex Assembly with Dynamic Simulator

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In present manufacturing scene, one of the requirements that arise is the use of general-purpose robots for complex tasks like engine assembly. In order to achieve these tasks, we need a deeper understanding of the tasks, for example, the relationship between the robot behavior and the change of the task states. However, it is difficult to analyze the complicated tasks by geometrically or statistically based methods. Therefore, we use a dynamic simulator to analyze the tasks in order to gain such understanding. Using the simulator for analysis allows us to measure phenomena that are too fine to be perceived in reality.

We analyze the clutch assembly which is highly required in manufacturing industry (Fig. 1). The clutch assembly is a complicated assembly task that needs a searching motion to insert a toothed clutch axis through a series of movable clutch plates with errors of translational position and angle against the axis. In our research, we especially investigate the qualitative relationships between searching motion and task efficiency. Analyzing the simulator's data (Fig. 2), we obtained that an increase in the searching speed shorten the time to achieve the assembly. However, increasing the searching speed makes the parts hard to fit in simultaneously, decreasing the efficiency (Fig. 3). Our results indicate the existence of an appropriate searching speed that will allow us to perform the tasks efficiently. We expect to use this analysis approach in various different complex tasks.

Keywords: Analysis, Dynamic Simulator, Robotic Assembly, Force Control

References

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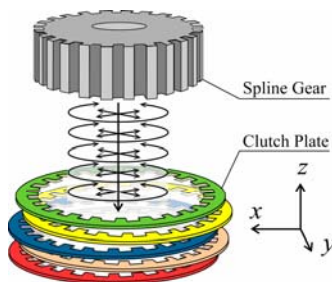


Fig. 1 Clutch assembly

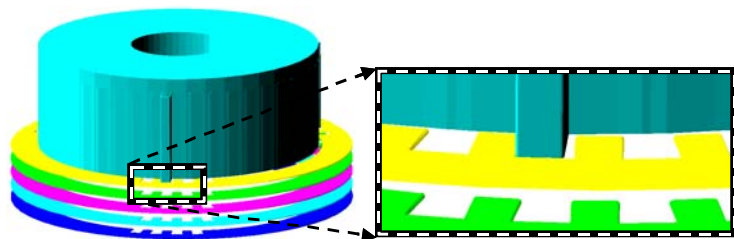


Fig. 2 Simulator of clutch assembly

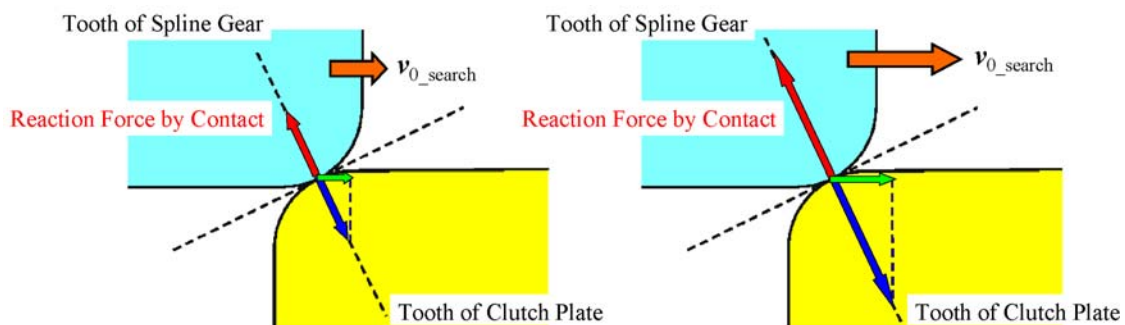


Fig. 3 Analysis of the operation