Reliability Issues and Solutions for Wafer Handling Robot Arms in Operation

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Abstract

Industrial robot arms are significant equipment to modern fabrication in a variety of industries since it can be easily programmed and moved on several directions to automatically perform various task regarding with welding, painting, pick-and-place, assembly, packaging, etc. Positioning-shift failure is a major defect of wafer handling robot arms, and it is one of the main reliability issues affecting the yield of semiconductor fabrication. In most cases, the failure caused by contact wear of transmission components to lead the undesired sliding or jumping motion. It appears occasionally as positioning and probably back to the normal condition in the next pick-up task resulting in the difficulty to test-and-validate at the robot producer side or in the lab using traditional reliability methodology. To solve the problem, developing a real-time condition monitoring for the handling robot arm in operation is necessary to prevent the occurrence of the critical failure. In this talk, I will show the intelligent real-time condition monitoring system developed by ours. The system contains stacked LSTM deep learning model and IoT-Edge Computing platform to in-line monitoring the operating condition, predicting the maximum eccentric quantity for next one-minute pick-ups, and make a proper decision and actions. The proposed model provides a superior prediction results regarding with the consistency between the predictive and actual values, and it also retained a high accuracy of prediction over a long-term period of time to demonstrate a reliable and trustworthy predictions. All of the information on User Interface (UI) of the platform were successfully updated when the real-time prediction has been accomplished, and warning messages were successfully sent by the platform once the decision has been made to fulfill the goal of real-time prediction and the decision-making process.