Targeted Multi-layer Shake-and-Catch Harvesting System for Fresh Market Apples

Currently, apples are harvested manually around the world, requiring a large, semi-skilled workforce during the short harvest window. Shake-and-catch technology has been successful in harvesting fruit for the processing market, but no commercial success has been achieved in harvesting fresh market fruit such as apples, pears, peaches, and cherries because of limited machine efficiency and high level of fruit damage. At Washington State University, a novel technology has been developed that consists of a precisely targeted shaking end-effector and mirrored copies of a multi-layer catching mechanism (collectively called targeted shake-and-catch) appropriate for harvesting apples in modern fruiting wall apple orchards. This technique was expected to substantially improve the fruit removal efficiency of the system by shaking the individual target branches instead of impacting the entire tree trunk or shaking the entire tree canopies. In addition, it was expected to decrease the likelihood of fruit damage by catching the removed fruits right underneath where they are (with minimal drop distance), thus maintaining the desired, marketable fruit quality.

Based on this concept, a semi-automated, hydraulically actuated harvesting system was developed. This system consists of three main components; a self-propelled orchard platform; a vibratory shaker powered by a hydraulic motor; and a mirrored, three-layer fruit catching mechanism with padded catching surfaces.