Using Stereo Photogrammetry to Model Strain through the Branch Connection Zone

Extended Abstract

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Branch failure is common issue in arboriculture, whether commercial, municipal, residential or utility. Modeling how branches withstand loads such as wind and ice, or fail, requires understanding how loads move along the lateral branch and into the parent stem/branch.

This research utilized stereo photogrammetry and a digital image correlation (DIC) system to measure tissue deformation (strain) during branch pulling exercises. Trunk samples with branches segments were obtained from white oak (*Quercus alba*) and chestnut oak (*Q. prinus*) trees growing in plantations and prepared with a white base paint and black speckling along the branch, attachment zone and stem. The DIC measures strain by tracking the movement of the black speckling throughout the exercises. Stain was measured during three time periods during the loading exercises: pre-failure, failure, post failure. Pre-failure was 2.5 seconds before failure, and post-failure was 2.5 seconds after failure.

The investigation will concentrate on mapping the magnitude of strain as a load is applied to a lateral branch. Specifically looking at how strain may differ between the top and bottom regions of the branch connect zone. Additionally, we will measure the dissipation of the strain as the load moves into the parent stem. We hope to address whether the strain follows a linear path down the parent stem (along a radial zone directly beneath the branch) or does the load fan out and move toward the back or opposite side of the stem.

Understanding how load moves along branch connection zones will add to the growing body of knowledge of how trees withstand or fail during loading events.