

Title Advances in Spectral Analysis of Vibrations for Non-destructive Determination of Tomato Firmness
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Abstract

Characteristics of fruit vibrations are related to the material properties of the fruit. A new method for spectral analysis is developed and used for the non-destructive estimation of tomato firmness. The resonant frequency of the first elliptical mode of the tomato is related to its firmness. However, the determination of the resonant frequency is not straightforward for highly damped fruits. Non-parametric smoothing is applied to the frequency spectra to obtain a robust estimate for the resonant frequency. The smoothing method is based on a statistical approach. The most important parameter that has to be determined is the smoothing parameter, as it determines whether the fitted function will be (too) smooth or (too) wavy. Risk estimation is used to find the optimal value. Using the proposed algorithm, fewer repeated measurements are needed for the assessment of the firmness of a single tomato.