

Ripeness detection of orange fruit using experimental and finite element modal analysis

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Abstract

Nowadays, promoting consumers' demand for high-quality products, has led to development of new technologies for assessment of agricultural products quality. Natural frequency is a dynamic property of fruits. In the present study, the modal analysis of the finite element method was used to determine the natural frequencies of orange fruit under different conditions of fruit ripeness by *SolidWorks* software. In this regard, the 3D model of orange fruit was created, and required material properties were measured and imported into the software. The first 18 requested natural frequencies of unripe and ripe orange fruits were calculated which were significantly different for these two groups and related vibrational mode shapes were plotted. For the evaluation of simulation outputs, an experimental test was done for determination of natural frequencies of the orange fruits. The results showed that the data obtained from the finite element method could be used with at least 91% accuracy. So, the finite element model and experimental method used in this study, can be used as a cost-effective and reliable method for ripeness detection of orange fruits.