

Title Instrumentation and procedures for commercial non-destructive determination of firmness of various fruits

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Abstract

A high interest in non-destructive instrumentation for firmness sensing of fruits is developing, and commercial laboratory and on-line equipment is already available. Many fruit handling lines offer NIR (plus VIS) systems, claiming that they can estimate firmness, in addition to chemical quality of fruits, as soluble solids. Optical firmness sensing is difficult or not feasible for many fruits, so that mechanical firmness devices are rapidly increasing presence in the market.

Mechanical firmness devices, which can be used on-line, as well as table-top in laboratory, are based on either of two principles: deformation by contact or vibration response to contact. Contact is of the fast type, being an impact with low energy, with a duration of a few milliseconds. The vibration response spectrum is analyzed after transformation into frequency-domain, and characteristic frequency is determined. In both techniques, deformation of fruit is encountered, being this related to structure of fruit flesh, and therefore to firmness.

Furthermore, both procedures can be (and are) combined in the same system. A review of the existing commercial equipment is made. Selected results on different fruits, which show experimental comparisons of different non-destructive with respect to destructive instruments are presented, showing the feasibility and better repeatability for non-destructive procedures. The need for standardising non-destructive firmness measurement of fruits is discussed.